Agera L2

The New **Reference Standard** for Color and Appearance Measurement.

Color. Confidence. Connected

HunterLab

Redefining accuracy, reliability, and appearance in every measurement

Table of Contents

HunterLab

Table of Contents

HunterLab

Table of Contents

Table of Contents

Table of Contents

About Agera L2™

The HunterLab Agera L2 redefines benchtop color measurement with next-generation speed, precision, and visual correlation. Engineered for opaque, textured, and semi-gloss materials, Agera L2 combines **0° illumination / 45° circumferential viewing geometry, integrated 60° gloss measurement, high-resolution imaging,** and **UV-controlled LED illumination**—all in one compact, intelligent system.

Its **True Calibrated D65 illumination**–the world's first true daylight engine ensures precise correlation between visual and instrumental color evaluations, while **Ultra Dark Mode** delivers unmatched accuracy for deep, low-reflectance colors.

Powered by onboard **EasyMatch Essentials L2** software, Agera L2 streamlines every step of color quality control, providing complete appearance data in a single measurement. It connects effortlessly with LIMS, MES, and SPC systems for secure, closed-loop color management.

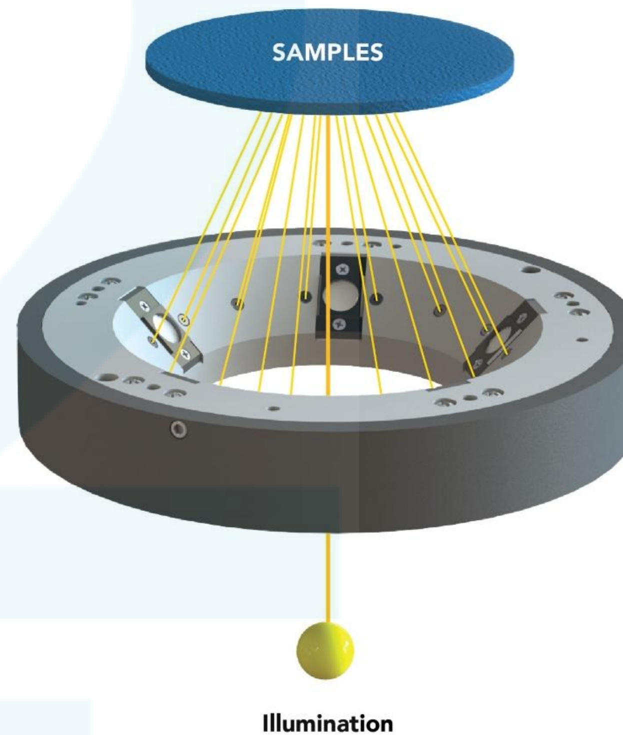
Designed for performance across plastics, coatings, paper, textiles, chemicals, pharmaceuticals, and building materials, the Agera L2 empowers manufacturers to see, measure, and manage color with absolute confidence.

Let's explore the Agera L2 unique features and advantages!

Agera L2 | Features in Detail

Feature | 0°/45°c (Circumferential) Reflectance Geometry

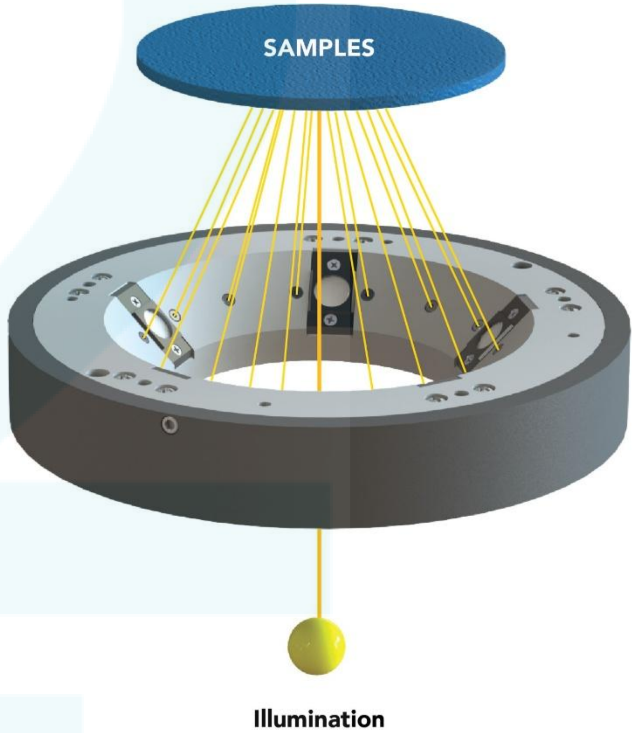
The HunterLab Agera L2 employs **0°/45°c Circumferential geometry,** the industry's most visually correlated configuration for measuring color as the human eye perceives it. In this geometry, the sample is illuminated perpendicularly at 0° while reflected light is collected at 45° by 15 optical sensors from a full 360° circle around the sample. This design eliminates directional bias caused by surface texture, gloss, or grain orientation—ensuring that the measured color matches what an observer sees. Because of its ability to capture uniform reflected light from all viewing angles, circumferential 0°/45° geometry has become the benchmark for evaluating surfaces where both color and appearance define quality.



Feature | 0°/45°c (Circumferential) Reflectance Geometry

Benefits:

- **Visually Correlated Measurements**: Delivers color readings that align with human visual perception.
- **Texture and Gloss Independence**: Minimizes directional errors caused by surface structure or finish.
- **Superior Consistency**: Provides highly repeatable results across different operators and sample types.
- **Ideal for Appearance-Critical Applications**: Ensures reliable color control in coatings, plastics, textiles, and consumer products.



Essentials TotalView 360° Auto Rotator Accessory

Confidence Through 360° Measurement

The Essentials TotalView 360° Auto Rotator Accessory (PN# L02-1021-858) provides complete 360° color evaluation of textured, directional, or non-uniform samples. The integrated sample clamp automatically rotates the specimen on the rotating port plate in 5° increments—up to 72 positions—capturing color at each orientation for true, comprehensive surface analysis. It then calculates mean color values and 95% confidence intervals using ASTM-style statistics to deliver the true average color, not just a single-angle snapshot. By automating this process, the system shortens time-to-decision, improves measurement precision, and eliminates repetitive manual repositioning. Ideal for heterogeneous materials, it converts complex surface behavior into clear, quantifiable color data.

HunterLab

Essentials TotalView 360° Auto Rotator Accessory

Geometry, Limitations, and Why TotalView 360° Matters

Real-world samples–fibers, films, pellets, prints, and coatings–often show directional effects such as grain, weave, gloss bands, and extrusion lines that change appearance depending on measurement angle. The Agera L2's 0° illumination / 45° circumferential geometry provides the industry's most visually correlated measurement for solid materials, but even the best geometry cannot sample an infinite number of directions.

The TotalView 360° Auto Rotator solves this by capturing color at every angle through a full 360° rotation and calculating ASTM-based statistics including mean, standard deviation, and repeatability (s_r and $r \approx 2.8 \cdot s_r$). The result is higher confidence, fewer false rejects, tighter tolerances, and more consistent color evaluations across labs–with less operator time and effort.

Essentials TotalView 360° Auto Rotator Accessory

How It Works

The TotalView 360° Auto Rotator Accessory consists of an Automated Sample Clamp and a Rotating Port Plate.

In operation, the user mounts the **2-inch rotating port plate** at the port receiver.

For flat samples, the **Automatic Sample Clamp** is placed directly on the specimen, pressing it against the port plate for stable contact.

HunterLab

Essentials TotalView 360° Auto Rotator Accessory

How It Works

For materials measured in sample cups, the clamp is raised and positioned either on the sample surface or on a light trap covering the cup.

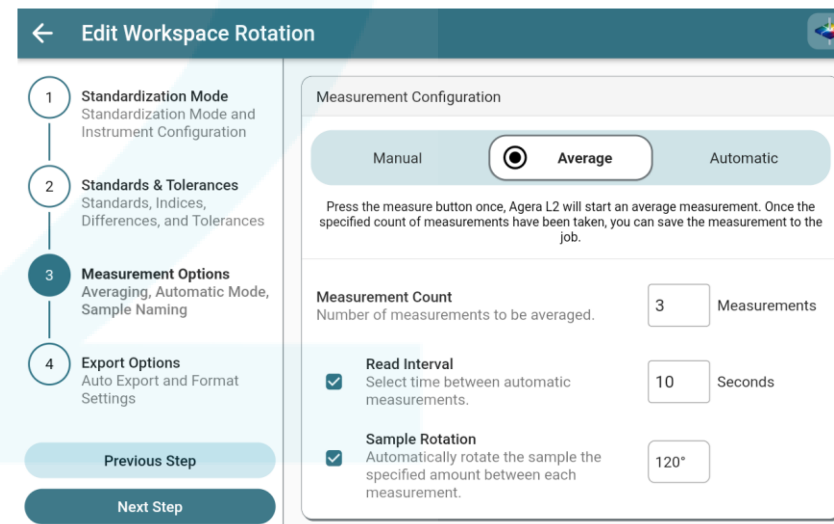
A full 360° scan completes in approximately 30 seconds, automatically computing repeatability, confidence intervals, and pass/fail outcomes. Results conform to ASTM E1164 and ASTM E308, ensuring credible, standards-based data that correlate directly with visual appearance and accelerate quality release.

Essentials TotalView 360° Auto Rotator Accessory

How It Works

Within **EasyMatch Essentials L2**, the user selects *Workspaces* → *Read Options* → *Automated Measurement* and chooses the number of rotational readings—from 2 to 72.

- Selecting 2 captures two readings 90° apart.
- All other values divide 360° by the chosen number (e.g., 3 = 120°, 72 = 5° increments).



Results display in Essentials L2 as:

- The **average** of all rotational measurements.
- The **individual component readings** for each rotation position.

HunterLab

Essentials TotalView 360° Auto Rotator Accessory

Applications and Quality Gains

Sample rotation delivers measurable advantages in industries where texture, directionality, or particle irregularity influence appearance.

- **Plastics**: Averages color across flow lines, gate marks, and molded surfaces.
- **Foods**: Stabilizes readings for powders, grains, coated, and particulate materials.
- **Textiles**: Neutralizes weave and fiber-orientation effects for uniform evaluation.
- **Packaging & Printing**: Minimizes gloss-band bias and print-direction variation.

Essentials TotalView 360° Auto Rotator Accessory

Benefits

- **360° Rotation in 5° Steps:** Captures complete anisotropic behavior automatically.
- **ASTM-Aligned Statistics:** Reports $\bar{x}$, σ, 95 % CI, and repeatability ($r \approx 2.8 \cdot s_r$
- **One-Touch Automation:** Replaces multiple manual re-measures in < 30 seconds.
- **Cross-Industry Applicability:** Effective for plastics, foods, coatings, packaging, textiles, and papers.
- **Higher-Confidence Decisions:** Truer averages, tighter tolerances, and faster QC release.

Feature | Calibrated D65 and Calibrated UV

Understanding D65: The Global Language of Daylight

D65 is the internationally defined "average daylight" illumination standard. It isn't simply a color temperature. D65 is a precise spectral power distribution (SPD)—a detailed curve that defines how much light exists at every wavelength across the visible spectrum and a portion of the near-UV.

Why does this matter?

Because the color of a material changes depending on which wavelengths of light are present. A material that looks correct under one light may shift under another, a challenge known as metamerism.

A high-fidelity D65 simulation gives manufacturers a stable, universal reference so colors match expectations in design studios, factories, and retail environments.

True Calibrated D65 Illumination

Feature | Calibrated D65 and Calibrated UV

How Instrument Makers Evaluate D65 Accuracy

Not all “D65” instruments are created equal. Two light sources can produce nearly identical CIE XYZ color values–but still differ noticeably in their spectral shape, resulting in misleading or unstable color measurements. To address this, the industry uses a metamer-pair evaluation method:

- Five challenging sample pairs are measured under the instrument’s D65 light.
- The color difference (ΔE) between each pair is calculated.
- The instrument is assigned an A–F rating based on the average ΔE.

True Calibrated D65 Illumination

Feature | Calibrated D65 and Calibrated UV

What the ratings mean:

- A rating: ΔE < 0.25 → excellent spectral match
- B rating: 0.25–0.50 → very good match
- C–F: lower fidelity, higher variation

This method evaluates spectral fidelity, not just color temperature or XYZ values. It is the most meaningful measure of whether an instrument captures the way daylight interacts with real materials. The Agera L2 achieves A–B level fidelity for both visible and ultraviolet metamer pairs, indicating strong alignment with D65 across the entire daylight spectrum.

True Calibrated D65 Illumination

Feature | Calibrated D65 and Calibrated UV

Why UV Matters More Than Many People Realize

D65 includes a small but important amount of near-UV energy (around 320–400 nm). This UV content plays a major role in how materials behave, particularly:

- Bright white plastics
- Papers containing OBAs
- Textile whites and fluorescent dyes
- Safety colors
- Highlighter pigments
- UV-reactive plastics and coatings

When UV is not calibrated, these products can shift significantly appearing either too dull, too bright, too blue, or too yellow depending on the instrument. Even materials that do *not* contain obvious fluorescence often have subtle UV-sensitive components. A calibrated UV source ensures that the material responds under the instrument the same way it responds in real daylight.

True Calibrated D65 Illumination

Feature | Calibrated D65 and Calibrated UV

Fluorescence: Only One Part of the Story

Visible-excited fluorescence is an important case, but it should not overshadow the broader value of daylight accuracy. Fluorescent materials emit visible light when stimulated by near-UV wavelengths. Getting this right requires:

1. A precise D65 spectral match
2. The correct amount of UV energy
3. Tight control of both over time

When all three are aligned, fluorescent materials—bright whites, OBAs, safety colors—behave as they do in a daylight booth. But fluorescence is not the reason calibrated D65 is important. The real value is that calibrated D65 and UV make all color measurements more accurate and stable.

True Calibrated D65 Illumination

HunterLab

Feature | Calibrated D65 and Calibrated UV

Industries That Benefit from Calibrated Daylight

Non-fluorescent materials: Even in materials without OBAs or dyes, D65 fidelity reduces metamerism and improves cross-lab consistency.

- **Examples**: Plastics, Paints, Coatings, Building materials, Packaging, Consumer goods, Anodized metals.

UV-sensitive materials: Even mild UV responses can shift whiteness, tint, or ΔE values if the UV content is incorrect.

- **Examples**: Bright white plastics, Uncoated papers, Natural fibers, Cosmetic powders.

Strongly fluorescent materials: These absolutely require calibrated daylight and calibrated UV for realistic measurement.

- **Examples**: OBAs, Optical whiteners, Safety colors, Fluorescent pigments, UV-active polymers.

True Calibrated D65 Illumination

Feature | Calibrated D65 and Calibrated UV

Keeping Fluorescence in Perspective

Fluorescence matters—especially for white and safety-color applications. But calibrated daylight benefits all materials, not just fluorescent ones. Calibrated daylight + calibrated UV improve overall accuracy; fluorescence is only one example.

True Calibrated D65 Illumination

What This Means for Manufacturers

A high-fidelity daylight engine is more than a specification—it is a quality system. With calibrated D65 and calibrated UV:

- Colors measured in the lab match what customers see in daylight
- Whites and brights stop drifting due to lighting differences
- Multi-site suppliers align to a single standard
- Pass/fail decisions become more dependable
- Lab-to-lab disagreements, metamer surprises, and rework decrease
- Fluorescent and non-fluorescent materials both become more predictable

This is how color measurement becomes not just accurate, but *trustworthy*.

Feature | Calibrated D65 and Calibrated UV

Conclusion

Daylight is the environment where most products are ultimately judged—on store shelves, in homes, outdoors, and in real-world use. Instruments that merely approximate D65 cannot reliably reproduce these conditions, leading to unnecessary variation and uncertainty.

By combining calibrated D65, calibrated UV, and metamer-validated spectral fidelity, manufacturers gain a more accurate, more stable, and more universal color foundation—one that supports modern materials, complex supply chains, and the high standards of today's global brands.

Feature | Ultra-Dark Mode

Precision for Deep Colors

Agera L2's **Ultra Dark Mode** is engineered for low-reflectance materials (**≤ 15 % across 400–700 nm**), the darkest blacks, navies, greens, and reds that define modern products. Conventional spectrometers struggle in this low-signal region, but Ultra Dark Mode optimizes illumination and integration automatically to raise the signal-to-noise ratio. When a sample qualifies, the system prompts "Ultra Dark Mode available," enabling one-click activation. **The result**: tighter repeatability, faster stability, and more reliable CIELAB values. Ultra Dark Mode helps you measure depth, not guess it, turning difficult, noise-limited readings into data you can trust.

Feature | Ultra-Dark Mode

How Ultra Dark Mode Works and Why It Matters

Dark colors reflect little light, producing weak detector signals that inflate variability. Ultra Dark Mode combats this by dynamically boosting photon capture and controlling exposure, improving precision without altering reported color values. It yields smaller **σ** (standard deviation) and narrower confidence intervals while preserving full spectral and colorimetric outputs (L*, a*, b*, ΔE). Users typically need only one reading to reach the "true" value, cutting time to truth and reducing rework. Optional jetness, blackness, and undertone indices (ISO 18314-3) extend the analysis for coatings, plastics, inks, and rubber, enabling the most accurate evaluation of ultra-dark materials ever achieved on a benchtop instrument.

Feature | Ultra-Dark Mode

Applications and Customer Impact

From automotive paints and appliance plastics to deep-tinted inks and textured polymers, Ultra Dark Mode delivers higher precision, fewer repeats, and tighter lab-to-lab alignment. Designers can distinguish colored depth – blue-black, forest green, maroon – without "looks black" confusion. Quality teams gain repeatable L* and ΔE_{00} values across instruments and shifts, improving process control and product consistency. In food applications, Ultra Dark Mode also supports analysis of dark natural or processed products (e.g., cocoa, coffee, beans, seaweed, charcoal breads). Across industries, Ultra Dark Mode eliminates instability in the ≤ 15 % reflectance regime, saving time, ensuring accuracy, and making the darkest materials measurable with confidence.

Feature | Ultra-Dark Mode

Benefits

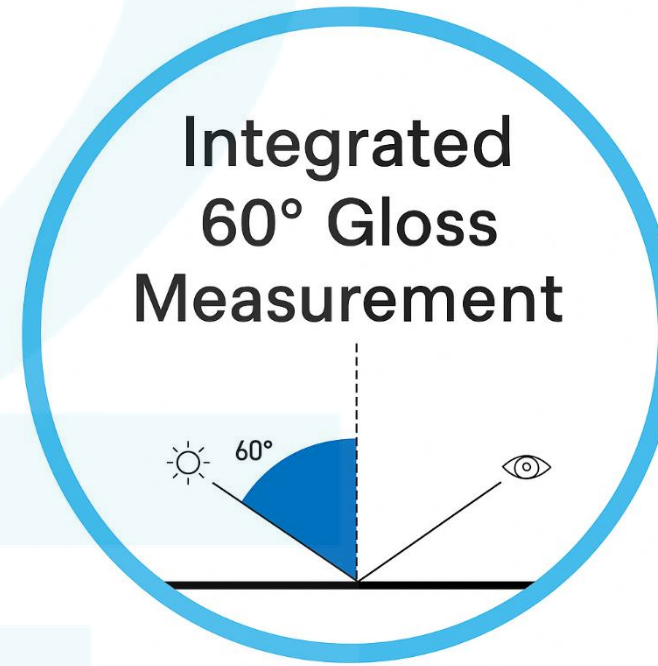
- **Purpose-Built for ≤ 15 % Reflectance**: Automatically detects and optimizes for ultra-dark samples.
- **Higher Repeatability & Accuracy**: Improved signal-to-noise = smaller **σ** and ΔE scatter.
- **Faster to Stable Results**: Usually one measurement to reach "true" value.
- **Same Outputs + More Insight**: Standard CIELAB data plus Ultra Dark Industry Standard Indices: Blackness (My, Mc, dM), Greyness (Gy, Gc, dG).
- **Broad Application Range**: Automotive, coatings, plastics, inks, foods, and rubbers.
- **Confidence in the Darkest Colors**: Reliable numbers where others struggle.

ULTRA
DARK
MODE

Feature | Integrated 60-degree Gloss Measurement

Why Surface Texture & Gloss Matter for Color

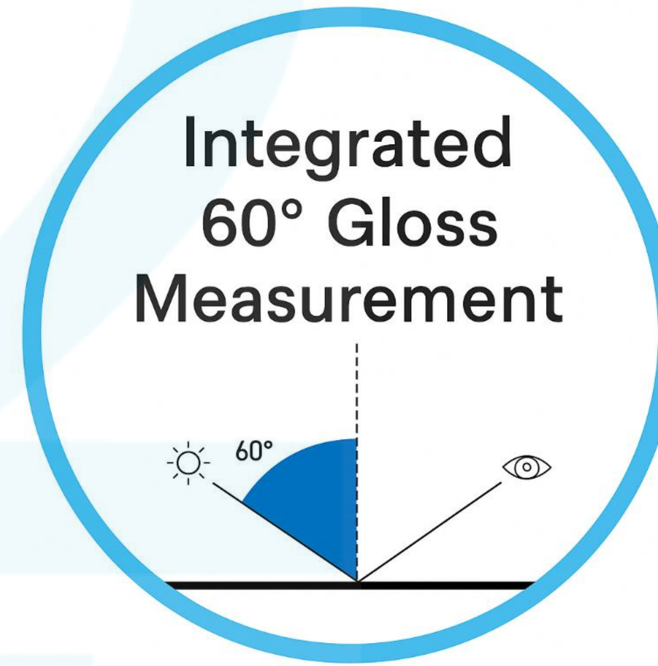
Surface finish plays a major role in how we perceive color. A high-gloss surface often appears darker and more saturated than the same pigment on a matte or textured substrate, because specular reflection alters light return, contrast and visual depth. For plastics, coatings, films and decorative materials, especially where brand identity or luxury appearance is at stake, these finish effects can undermine color consistency if ignored. By integrating both color and gloss measurement in one instrument, manufacturers can move from "looks good visually" to "measured, certified appearance", reducing visual surprises between lab, print or production lines.



Feature | Integrated 60-degree Gloss Measurement

Why 60° Gloss Is the Universal Angle for Plastics

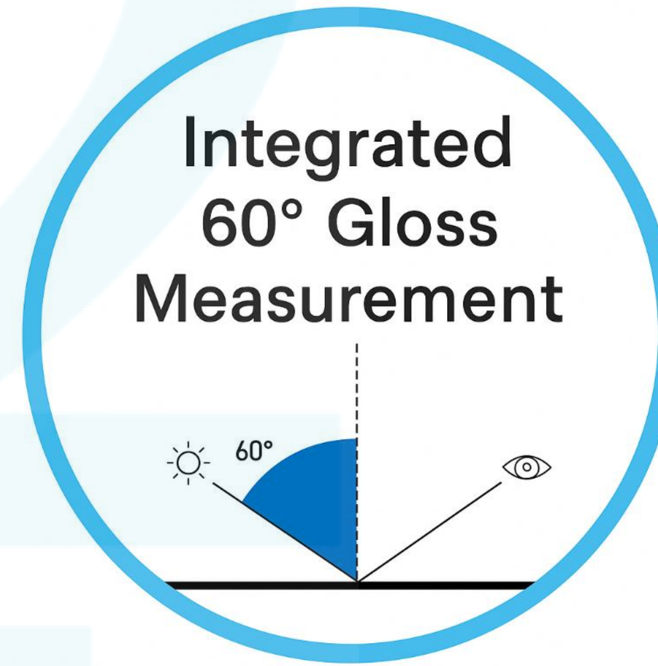
The Agera L2 features an **integrated 60° gloss meter**, conforming to international standards ASTM D523 and ISO 2813. 60-degree gloss is the default universal angle most widely used for plastics and general industrial surfaces because the 60° angle provides a balanced reflection path, neither too shallow (which exaggerates specular peaks) nor too steep (which reduces gloss sensitivity). It works well across dark, light, textured and smooth surfaces. Integrating gloss at this angle with color measurement permits consolidated QC workflows, lower instrument count, and faster decisions.



Feature | Integrated 60-degree Gloss Measurement

How Agera L2 Combines Color + Gloss for Better Appearance Control

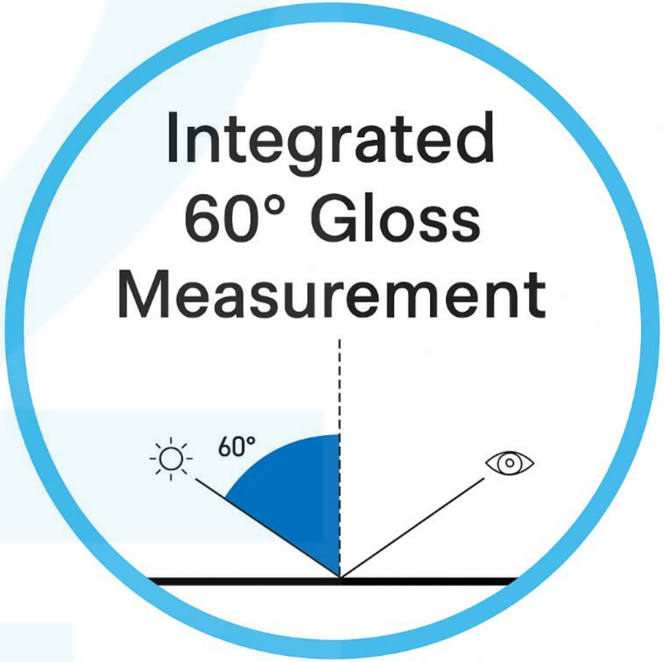
With the Agera L2 you don't just get separate color and gloss readings–you get simultaneous acquisition of reflectance color (0°/45° geometry) and 60° gloss in the same measurement event. This means that finish effects (gloss, haze, surface texture) are recorded and tied to the color data, allowing QC and brand teams to correlate "why does this same color look different when the finish changes?" **The result**: fewer second-guesses, faster approval cycles, and better global alignment of appearance across suppliers, plants and brands.



Feature | Integrated 60-degree Gloss Measurement

Benefits

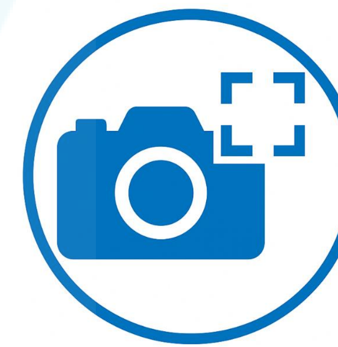
- **Surface texture & gloss influence perceived color** – gloss often makes colors look deeper/lusher.
- **60° gloss angle is ideal for general industrial plastics and appearance QC,** supported by ASTM D523 and ISO 2813 standards.
- **Agera L2 integrates color + gloss measurement in one hit,** removing separate workflows and aligning data.
- **Simultaneous measurement =** better correlation between instrumental data and visual appearance, fewer surprises downstream.
- **Improved appearance consistency across finish variants,** e.g., matte vs gloss of same material or pigment.
- **Faster, data-driven approvals for appearance-critical materials,** less hand-holding, more confidence.



Feature | Integrated High-Resolution Imaging System

The HunterLab Agera L2 features an integrated high-resolution embedded camera designed to deliver real-time visual confirmation for every color measurement. The system uses a 2592 × 1944 active-array sensor (5 MP) with a 1/4" optical format and 1.4 µm × 1.4 µm pixel size, providing crisp, detailed surface images of the sample area. Its high sensitivity (600 mV/lux-sec) and low-noise OmniBSI™ sensor architecture ensure clear imaging even on dark or low-reflectance materials. During each reading, the camera captures a calibrated image of the exact measurement spot, allowing operators to verify sample placement, detect surface contamination, confirm texture orientation, and document visual appearance alongside numerical color and gloss data.

With support for LED/flash strobe, auto white balance, auto exposure, and automatic black-level calibration, the system continuously produces consistent and reliable images. Captured images can be stored, exported, and included in batch records, audits, or customer reports, providing visual traceability that directly links every measurement to its physical sample. This image-assisted workflow improves confidence, reduces operator error, and strengthens quality documentation across production lines, suppliers, and global sites.

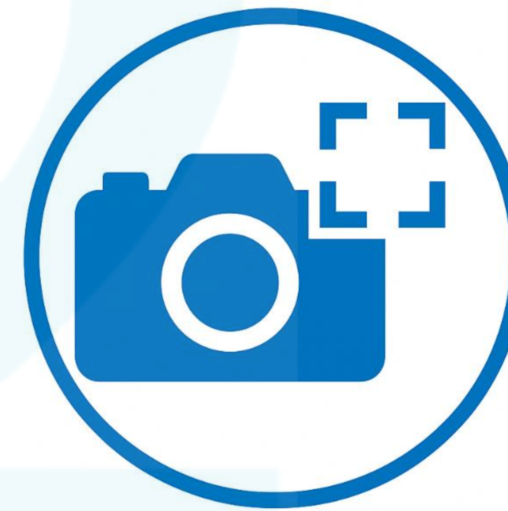


High-Resolution Imaging

Feature | Image Capture

Benefits:

- **Real-Time Visual Verification:** Embedded camera confirms proper sample alignment and measurement area before each reading.
- **Enhanced Quality Assurance:** Detects surface defects, contamination, or texture variations that could affect results.
- **Image Documentation:** Stores sample images with color data for traceability, audits, and customer reporting.
- **Improved Confidence and Accuracy:** Combines visual and numeric data to ensure each measurement reflects the true sample appearance.



High-Resolution Imaging

Feature | Local Action/Read button

The HunterLab Agera L2 combines advanced technology with intuitive usability. Its **built-in touchscreen interface** allows operators to easily navigate menus, create and select workspaces, and perform measurements without the need for an external computer. The clear, icon-driven layout simplifies setup and operation, making it ideal for both new and experienced users. In addition to the touchscreen, the Agera L2 includes a **dedicated local action read button** for reading samples and executing key functions. This provides a convenient, one-touch operation that speeds up workflow and minimizes handling errors–especially useful when measuring multiple samples or working with gloves in production environments. Together, these features make the Agera L2 both powerful and effortless to operate, ensuring consistent, efficient color measurement across users and locations.

Feature | Local Action/Read button

Benefits:

- **Dedicated Physical Read Button**: Allows fast, reliable sample readings without navigating menus.
- **Glove-Friendly Design**: Enables easy operation in laboratory or production environments.
- **Streamlined Workflow**: Speeds up repetitive measurements and reduces operator fatigue.
- **Consistent Results Across Users**: Ensures uniform, error-free color measurement regardless of operator experience.

Feature | Sealed Enclosure

The HunterLab Agera L2 is built for reliability and longevity in real-world production environments. Its **sealed optical engine and fully enclosed housing** protect critical components from dust, powders, and accidental spills–conditions that are common when measuring paints, coatings, chemicals, plastics, and other industrial materials. By isolating the optics and electronics from environmental contamination, the Agera L2 maintains calibration stability and optical precision over years of use, even in high-traffic laboratories or harsh manufacturing settings. This rugged, low-maintenance design ensures consistent, trouble-free performance whether the instrument is used in a clean lab or directly on the production floor.

Sealed Enclosure

Feature | Sealed Enclosure

Benefits

- **Sealed Optics and Enclosure:** Protects the optical engine and electronics from dust, powders, and liquid spills.
- **Long-Term Calibration Stability:** Maintains optical precision and measurement reliability even in harsh or high-use environments.
- **Low-Maintenance Operation:** Reduces downtime and the need for frequent servicing or recalibration.
- **Versatile Performance:** Performs consistently in both controlled laboratory settings and demanding production-floor conditions.

Sealed Enclosure

Feature |EasyMatch Essentials™ On-board Software

At the core of the Agera L2 is **HunterLab EasyMatch Essentials**, the powerful onboard software that delivers a complete, self-contained environment for measurement, data management, and report generation–all without the need for an external computer. Pre-installed within the instrument, it enables fast setup, streamlined workflow, and secure local data storage directly from the touchscreen interface.

Feature | EasyMatch Essentials™ On-board Software

Complete On-Board Control

The HunterLab Agera L2 combines advanced technology with intuitive usability. Its built-in touchscreen interface allows operators to easily navigate menus, create and select workspaces, and perform measurements without the need for an external computer. The clear, icon-driven layout simplifies setup and operation, making it ideal for both new and experienced users.

The integrated **Essentials software** runs on the Agera L2's internal processor and touchscreen interface, giving operators immediate access to colorimetric functions, pass/fail evaluation, and visual trend charts. Templates and tolerance limits can be stored locally, ensuring consistency across users and shifts.

Feature | EasyMatch Essentials™ On-board Software

Large Format Viewing

For enhanced analysis or large-format viewing, the Agera L2 connects directly to an external monitor via HDMI—expanding the workspace for side-by-side data comparison, collaborative reviews, or operator training.

Feature |EasyMatch Quality Central™ advance data management and reporting software

PC Based Software

For laboratories that prefer a PC-based workflow, the Agera L2 integrates seamlessly with **EasyMatch Quality Central**, the enhanced desktop version of Essentials. This advanced platform expands functionality with multi-instrument management, third-party software connectivity, more advanced analysis , and cloud-based data backup and restore, supporting enterprise-wide color control and long-term traceability.

Feature | EasyMatch Software Solution Benefits

Whether operated as a stand-alone workstation with **EasyMatch Essentials™**, connected to a **Large Format Display** , or integrated into **EasyMatch Quality Central™**, Agera L2 delivers the same trusted results with less hardware, fewer steps, and complete data traceability.

EasyMatch Essentials™
Complete
On-board Control

EasyMatch Essentials™
Complete On-board Control
with
Large Format Viewing

EasyMatch Quality Central™
PC Based
Advanced Data Management and Reporting

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

In pharmaceutical and biotechnology manufacturing, every analytical instrument must deliver not only accurate measurements but also secure, compliant, and traceable data. Agera L2 is engineered to meet these expectations through integrated data protection, audit trail management, and compliance features aligned with **FDA 21 CFR Part 11, EU Annex 11,** and global **Good Manufacturing Practice (GMP) requirements.**

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

Secure Data Architecture

Agera L2 stores color data within a **protected file system** that ensures data integrity from acquisition through export. Each measurement record includes automatic time-stamping, user ID, instrument serial number, and calibration reference, creating a permanent trace of the analytical event. Data files are write-protected

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

Audit Trail and User Accountability

The Agera L2's **audit logging system** automatically records all critical system events–including calibration, tolerance editing, standard updates, and measurement actions–with corresponding user credentials and timestamps. This audit trail allows compliance managers and QA personnel to verify every action affecting test data. Audit logs are non-erasable and exportable in standard electronic formats for archiving or regulatory review.

Role-based access control supports multiple operator levels–Administrator, Supervisor, and Operator–each with defined permissions for instrument operation, configuration, and tolerance management. User authentication can be managed locally or through network credentials, ensuring consistent enforcement of security policies.

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

Compliance Alignment

Agera L2 supports the documentation and verification expectations outlined in:

- FDA 21 CFR Part 11 – Electronic Records and Signature
- EU Annex 11 – Computerized Systems in GMP Environments.
- USP – Analytical Instrument Qualification.

HunterLab

Feature | Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

Regulatory Confidence through EasyMatch Essentials-ER

When operated through its embedded EasyMatch Essentials or EasyMatch Quality Central PC based software, Agera L2 offers **controlled, user-authenticated workflows** with **secure data storage** directly on the instrument. Measurement methods, tolerances, and product standards are version-controlled, and results can be exported directly to compliant data-handling environments or backed up through encrypted USB transfer.

For extended functionality, the system connects via USB to a secure PC-based EasyMatch QC environment, where additional validation tools—such as **e-signatures**, **audit trails**, and **multi-instrument network control**—can be implemented without compromising regulatory compliance.

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

The Agera L2 provides bio-pharmaceutical manufacturers with more than precise color and gloss measurement–it delivers regulatory confidence. Its **secure architecture**, **traceable audit functions**, and **compatibility with Part 11 and Annex 11 frameworks** allow laboratories to integrate appearance data directly into validated quality systems without compromising compliance.

From powder blending and tablet coating to capsule color verification, Agera L2 ensures that every measurement not only meets specification but also satisfies the highest standards of data integrity required in regulated pharmaceutical production.

Feature |Data Security, Audit Logging, and 21 CFR Part 11 Readiness for Bio-Pharmaceutical Applications

Benefits

The Agera L2 provides bio-pharmaceutical manufacturers with more than precise color and gloss measurement–it delivers regulatory confidence. Its **secure architecture**, **traceable audit functions**, and **compatibility with Part 11 and Annex 11 frameworks** allow laboratories to integrate appearance data directly into validated quality systems without compromising compliance.

From powder blending and tablet coating to capsule color verification, Agera L2 ensures that every measurement not only meets specification but also satisfies the highest standards of data integrity required in regulated pharmaceutical production

Feature |Seamless Integration with LIMS & SPC Systems

Modern manufacturing environments depend on digital connectivity, and the Agera L2 is engineered for effortless data integration. Its open-architecture design and standard communication ports make connections to existing **Laboratory Information Management Systems** (LIMS) and **Statistical Process Control** (SPC) platforms straightforward and secure.

Feature |Seamless Integration with LIMS & SPC Systems

Ethernet + USB Connectivity

Agera L2 features **Ethernet TCP/IP** for direct or networked communication. Measured color and gloss data can be automatically exported for real-time SPC trending or archived batch documentation. Through Ethernet, multiple instruments can be linked across production lines or QA labs, allowing central data capture into plant-wide quality systems.

Feature | Seamless Integration with LIMS & SPC Systems

Easy System Integration

HunterLab's **open data protocols** enable seamless communication with third-party software packages. Color results, gloss values, and imaging metadata can be transmitted automatically to any database or process-control environment, reducing transcription errors and ensuring traceable, time-stamped data flow. Whether monitoring ΔE performance trends or verifying lot-to-lot consistency in a networked LIMS or SPC environment, Agera L2 provides the connectivity to enable manufacturers to thrive in the Next-Generation Intelligent Manufacturing Era–where data, AI, and human expertise converge.

Feature | Seamless Integration with LIMS & SPC Systems

Benefits

- Plug-and-play connection via Ethernet TCP/IP–no proprietary drivers.
- Automatic data export to LIMS, SPC, or MES systems.
- Real-time color trending and remote diagnostics.
- Secure, traceable communication compliant with GMP and ISO 17025 workflows.

Agera L2 | Use Cases

Use Cases

01 Bio-Pharmaceuticals

02 Building Materials

03 Chemicals and Minerals

04 Denim

05 Paint and Coatings

06 Paper

07 Plastics and Resins

08 Textile Laundering

09 Textiles, Fibers & Fabrics

1. Bio-Pharmaceuticals

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Bio-Pharmaceutical Solids & Powders Color Control

The Agera L2 represents a new benchmark in benchtop spectrophotometry, combining 0°/45° circumferential geometry, integrated 60° gloss measurement, imaging, and automated UV control in one compact platform. Purpose-built for real-world production and laboratory environments, Agera L2 delivers human-eye-correlated color and gloss data with the precision, stability, and repeatability expected from HunterLab.

Overview

In bio-pharmaceutical manufacturing, color is a key quality attribute that reflects **formulation integrity**, **coating uniformity**, and **product identity**. From powders and blends to tablets, pills, capsules, and caplets, consistent color ensures consumer confidence and regulatory compliance. Subtle color shifts can indicate formulation changes, oxidation, or process variation, making instrumental color measurement a critical step in Good Manufacturing Practice GMP) quality control.

The HunterLab Agera L2 provides an all-in-one solution for measuring color and appearance across solid-dosage and powder products. With its 0°/45° circumferential geometry—matching how the human eye perceives reflected color—and integrated gloss measurement, Agera L2 delivers precise, repeatable data that quantify product uniformity at every manufacturing stage.

Key Application

1. Powdered Drug Products

For raw materials, granulations, and powder blends, the Agera L2 provides quantitative color and appearance metrics that complement **Process Analytical Technology** (PAT) and **Quality-by-Design** (QbD) initiatives in pharmaceutical manufacturing. Its 0° illumination / 45° circumferential geometry and UV-controlled illumination allow precise, visually correlated evaluation of powders and excipients without complex sample preparation—ideal for both laboratory analysis and in-process verification.

.

Key Benefits

1. Powdered Drug Products

- **Raw APIs and Excipients**: Track ΔE, L*, a*, b* color and Yellowness Index (YI) to identify impurities, oxidation, or moisture uptake that may indicate degradation or contamination.
- **Blend Uniformity**: Monitor ΔE trends during blending to confirm end-point homogeneity before compression or encapsulation, ensuring consistent dosage form appearance.
- **Lyophilized and Coating Powders**: Detect early signs of degradation, discoloration, or uneven drying through measurable color differences, providing a rapid, non-destructive alternative to visual inspection.
- **Direct Measurement Capability**: Evaluate loose or granulated powders directly in a flat sample dish, avoiding compaction or reflection bias while maintaining representative optical scatter.
- **Regulatory Confidence**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software support electronic records, tolerance management, and traceable audit trails, aligning with 21 CFR Part 11 and GMP requirements.

Summary

1. Powdered Drug Products

Because the Agera L2 measures powders directly—without dilution, pressing, or additional sample prep—it supports real-time **in-process checks, blend-to-blend comparisons**, and **batch-release verification**, giving pharmaceutical producers faster feedback, stronger quality control, and complete confidence in every production lot.

HunterLab

Key Application

2. Tablets, Pills, Capsules, and Caplets

Solid-dosage uniformity is both aesthetic and functional. Variations in **coating thickness**, **polishing**, or **drying** can create perceptible shade differences that undermine brand identity, consumer confidence, and regulatory compliance. The Agera L2 quantifies these differences objectively, providing precise, traceable color data for every stage of tablet, capsule, and caplet production.

HunterLab

Key Benefits

2. Tablets, Pills, Capsules, and Caplets

- **Tablet Coating Uniformity**: Measure film-coat consistency and drying balance using ΔE thresholds for real-time quality feedback and process optimization.
- **Capsule Color Matching**: Compare shell hues across suppliers or production sites under identical 0° illumination / 45° circumferential viewing geometry, ensuring visual equivalence and brand uniformity.
- **Uncoated Tablets**: Evaluate compression, granulation, and polishing effects on reflectance; identify burnishing or residual lubricant films that alter perceived shade.
- **Precision Sample Holders**: Dedicated custom pill, tablet, and capsule fixtures position each sample consistently and repeatably, ensuring reliable measurement alignment—critical for small, curved, or irregular dosage forms.
- **Regulatory Confidence**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software support electronic records, tolerance management, and traceable audit trails, aligning with 21 CFR Part 11 and GMP

Summary

2. Tablets, Pills, Capsules, and Caplets

Each measurement performed with the Agera L2 ensures consistent optical alignment, repeatability, and full data traceability, supporting compliance with **21 CFR Part 11**, **GMP**, and **global pharmacopoeia guidelines**. By combining precise geometry, illumination, and specialized sample handling, the Agera L2 provides a complete solution for appearance control in solid oral dosage manufacturing–from R&D through final batch release.

Key Application

3. Appearance-Critical Pharmaceutical Components

The Agera L2 provides a complete solution for evaluating appearance-critical pharmaceutical components, where both color and surface finish play a vital role in product quality and patient perception. Many film-coated tablets, softgels, and capsule shells exhibit gloss variation that directly influences perceived shade and visual uniformity. The Agera L2's simultaneous color and gloss measurement capability enables accurate correlation between coating appearance and visual evaluation, ensuring consistent finish quality across production batches.

HunterLab

Key Benefits

3. Appearance-Critical Pharmaceutical Components

- Color + Gloss Integration: Measures color and 60° gloss simultaneously, capturing how surface reflectance affects perceived hue on coated and polished dosage forms.
- Imaging Verification: Built-in high-resolution imaging provides a visual record of the measured area, confirming coating uniformity and detecting defects such as mottling, speckling, or uneven spray patterns.
- Defect Detection: Identifies early process deviations in film-coating, pan-coating, or fluid-bed applications before they result in batch rejection.
- Regulatory Alignment: Objective, documented appearance data support GMP compliance and reduce reliance on subjective visual grading.
- Process Optimization: Real-time feedback enables tighter coating control and faster troubleshooting of equipment or formulation issues.

HunterLab

Summary

3. Appearance-Critical Pharmaceutical Components

By combining color, gloss, and imaging analysis in one instrument, the Agera L2 helps pharmaceutical manufacturers ensure that every coated product meets **appearance**, **quality**, and **regulatory expectations**, reinforcing brand integrity and patient trust through measurable, traceable visual consistency.

HunterLab

Industry Standards & Methods

- USP – Color and Appearance Measurement of Pharmaceutical Products.
- EP 2.2.2 – Degree of Coloration of Liquids and Solids.
- ASTM E1164 / E1349 – Spectrophotometric Reflectance Measurement of Non-metallic Materials.
- ASTM D523 / ISO 2813 – Specular Gloss Determination.
- CIELAB – Standard Color Space for Human-Vision Correlation.

HunterLab Advantage

Agera L2 delivers pharmaceutical-grade precision in a single, easy-to-use platform.

- 0°/45° Circumferential Geometry: Mirrors human visual response while minimizing glare on glossy coatings.
- Automated UV Control: Enables accurate evaluation of optical brighteners and fluorescent excipients.
- Imaging Functionality: Captures and stores measurement-spot images for visual verification and electronic batch records.
- High Repeatability (ΔE 0.02): Ensures consistent results across instruments, shifts, and sites.
- Regulatory Confidence: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software support electronic records, tolerance management, and traceable audit trails, aligning with 21 CFR Part 11 and GMP requirements.
- Seamless Integration with LIMS & SPC Systems: Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.

HunterLab Advantage

- **Embedded EasyMatch Essentials Software:** Complete On-Board Control provides full measurement and reporting capability right from the touchscreen.
- **PC & External Display Connectivity:** Connect via USB to a PC for expanded analysis, long-term storage, or multi-instrument networking. Link to an external display for group training or collaborative QA review.
- **Simplified Operation:** Reduces training time and ensures consistent user performance.
- **21 CFR Part 11-ready data acquisition and audit logging:** Role-based access and password authentication for all users, non-erasable audit trail with secure time-stamped entries, validated data transfer via Ethernet or USB to LIMS/SPC systems, and integrated compliance with GMP, USP, and EU Annex 11 documentation standards.

With these capabilities, Agera L2 bridges sensory evaluation and objective analysis, helping QC teams standardize appearance control across global manufacturing networks.

Summary

Color in bio-pharmaceutical solids and powders is more than visual—it is a measurable indicator of **process control** and **product quality**. The HunterLab Agera L2 empowers manufacturers to quantify those attributes with precision, repeatability, and regulatory confidence.

From verifying blend uniformity to ensuring coating integrity, Agera L2 enables immediate, data-driven decisions that reduce variability and accelerate release testing. Its 0°/45° geometry, integrated gloss capability, and imaging verification make it the definitive instrument for color and appearance analysis in solid-dosage pharmaceuticals.

Whether measuring powder intermediates, film-coated tablets, or finished capsules, Agera L2 provides a new level of accuracy and traceability—delivering confidence in every batch and consistency patients can see.

2. Building Products

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Building Materials Color & Appearance Control

The Agera L2 defines a new standard for appearance control in architectural and construction materials. Combining 0°/45° circumferential geometry, integrated 60° gloss measurement, imaging, and automated UV control, it delivers accurate, repeatable color data that align with human visual perception – even on textured, irregular, or reflective building materials.

HunterLab

Overview

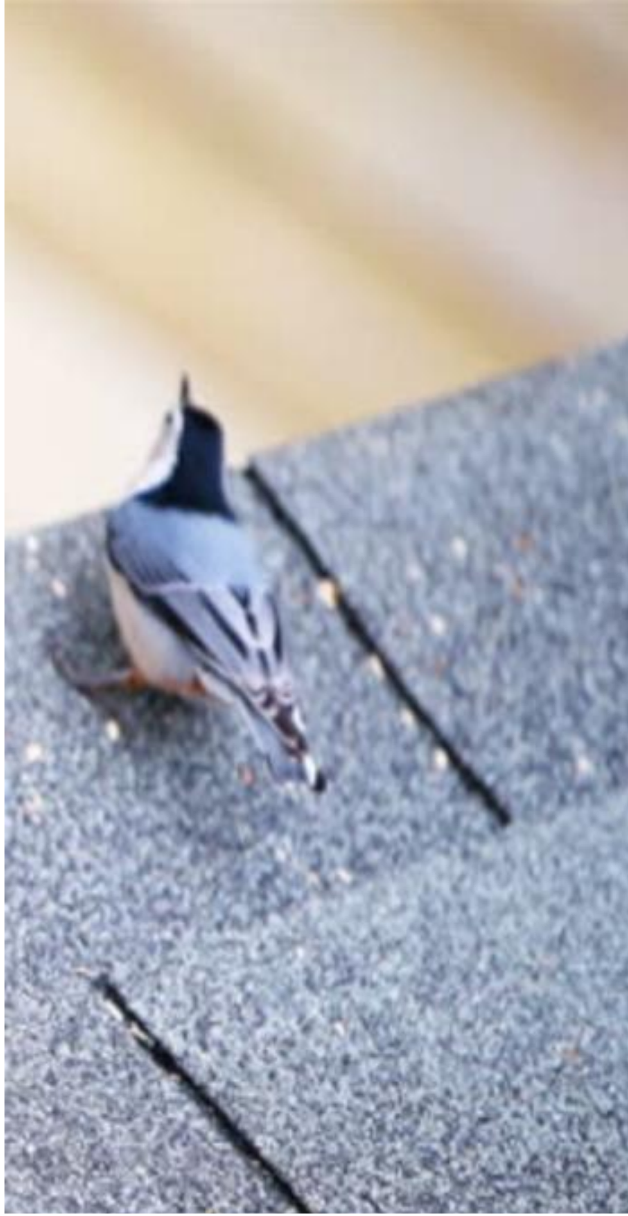
In the building-materials industry, color consistency communicates durability, brand identity, and weathering performance. Roofing granules, coated metal panels, shingles, and concrete finishes all must maintain precise visual uniformity across production lots and installation sites.

The Agera L2 provides the definitive solution for quantifying both **color and gloss** on these challenging, non-uniform surfaces. Its circumferential **0 ° /45° circumferential viewing** averages across texture and orientation to deliver readings that match visual appearance under daylight or artificial illumination.

Key Application

1. Roofing Granules and Shingles

The Agera L2 provides comprehensive color and appearance evaluation for roofing granules and asphalt shingles, materials where texture, coating uniformity, and weathering resistance directly affect both performance and visual appeal. Its large 51 mm (2-inch) measurement port and 0°/45° circumferential geometry capture broad, representative readings across coarse, irregular, or coated surfaces–delivering accurate, repeatable data that correlate with what the human eye perceives on finished roofing products.

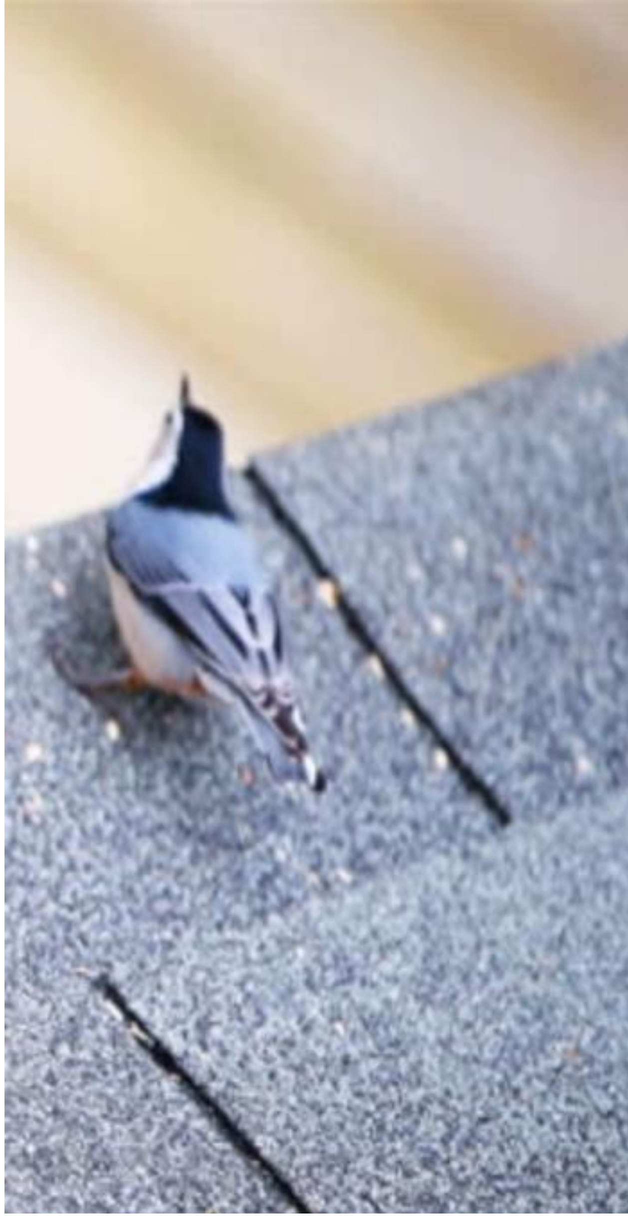


HunterLab

Key Benefits

1. Roofing Granules and Shingles

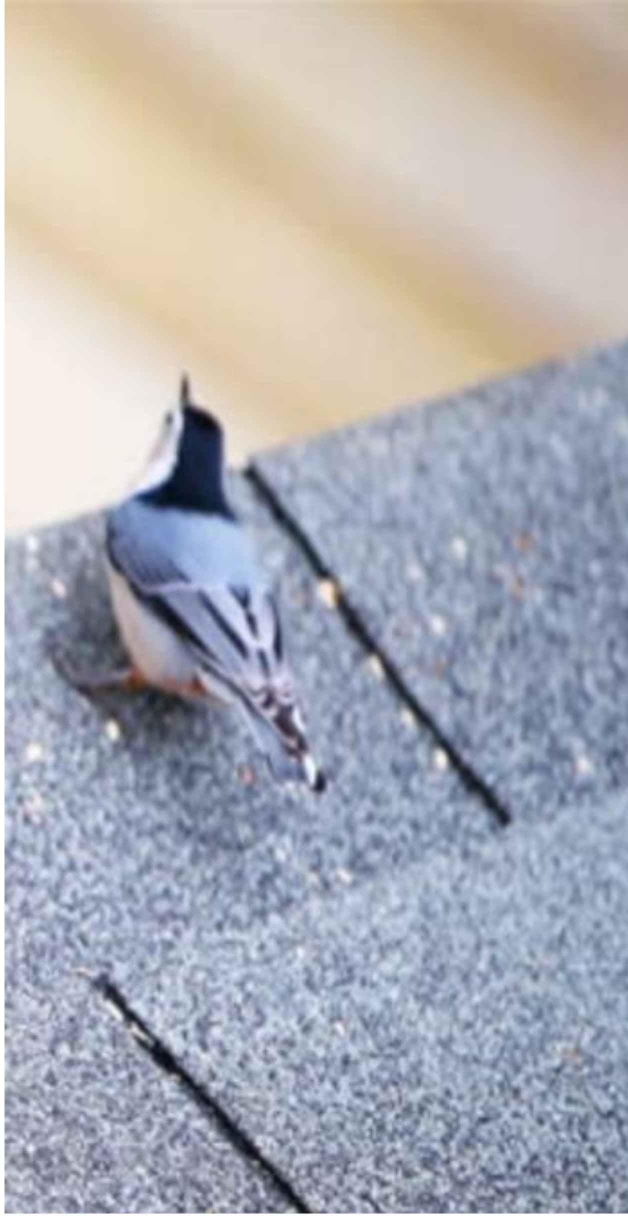
- **Texture Averaging**: The large-area port measures across rough, angular, or multi-colored granules, minimizing the influence of surface irregularities and providing stable, repeatable results.
- **Weathering and Fade Testing**: Monitors ΔE, L*, a*, b* and YI shifts following accelerated UV or environmental exposure to quantify color durability and pigment stability over time.
- **Binder and Coating Uniformity**: Detects subtle hue, brightness, or gloss changes related to coating load, resin cure, or surface dusting–critical indicators of process consistency.
- **UV-Controlled Evaluation**: UV-included and UV-excluded modes enable accurate assessment of reflective or "cool roof" pigments, ensuring compliance with solar-reflective color performance criteria.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.



Summary

1. Roofing Granules and Shingles

By combining large-area measurement and UV control the Agera L2 equips roofing material manufacturers with the tools to **maintain consistent appearance**, **verify weathering performance,** and ensure that every shingle or granule-coated surface **meets both aesthetic and functional standards** for today's architectural and energy-efficient roofing systems.



HunterLab

Key Application

2. Architectural and Metal Panels

Agera L2 delivers precise and visually correlated appearance measurement for architectural and metal panels, including painted, powder-coated, and coil-coated steel or aluminum substrates used in building façades, roofing, and cladding systems. Its 0° illumination / 45° circumferential viewing geometry provides accurate color evaluation on both smooth and textured surfaces, while the integrated 60° gloss sensor quantifies surface reflectance to ensure that both color and finish meet design intent and specification tolerances.

HunterLab

Key Benefits

2. Architectural and Metal Panels

- **Comprehensive Coating Measurement**: Accurately evaluates paint, powder, and coil coatings on a variety of metallic substrates, from high-gloss architectural panels to low-sheen industrial finishes.
- **Gloss Correlation and Control**: Simultaneous color and gloss measurement ensures consistent appearance across production runs, confirming both parameters remain within defined tolerances.
- **Field Verification and Alignment**: Agera L2's data format aligns with ASTM D2244 (color) and ASTM D523 (gloss), simplifying communication between coil coaters, panel fabricators, and on-site installers.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

2. Architectural and Metal Panels

By integrating color, gloss, and texture analysis into one instrument, the Agera L2 enables architectural coating producers and metal panel manufacturers to achieve **consistent aesthetic performance** from factory production to field installation—ensuring every façade meets both engineering specifications and visual expectations.

HunterLab

Key Application

3. Wet and Dry Cement

Cement presents a unique color-measurement challenge due to its dynamic optical behavior during hydration and curing. In its wet state, cement appears darker and glossier; as it dries, it becomes lighter and more diffuse, with surface reflectance varying according to porosity and texture. These changes can lead to perceptible color variation between production batches or across curing conditions. The Agera L2 provides manufacturers of bagged cement, pre-mix, and precast components with the ability to measure appearance accurately through every stage—from initial hydration to full cure—ensuring brand uniformity, batch-to-batch consistency, and predictable end-user appearance.

Key Benefits

3. Wet and Dry Cement

- Visual Correlation Across States: Measures color precisely through hydration, drying, and curing, providing consistent appearance data for both wet and dry conditions.
- Texture Averaging: The large-area port and circumferential viewing geometry minimize variability from rough, porous, or uneven surfaces, ensuring accurate representation of real-world product texture.
- Color + Gloss Integration: Simultaneously captures tone and surface reflectance differences from wet to dry, producing a complete and repeatable appearance profile for quality assurance and customer verification.
- UV-Controlled Evaluation: UV-included/excluded modes detect the effect of curing additives, pigments, or fillers on brightness and shade stability.
- Data Integration and Reporting: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

3. Wet and Dry Cement

By capturing both optical tone and gloss behavior, the Agera L2 allows cement producers to precisely manage visual quality from mix design through final cure, ensuring **consistent aesthetic performance** and **reliable customer satisfaction** across all products and sites.

HunterLab

Key Application

4. Concrete and Pre-Cast Panels

In architectural and structural concrete applications, maintaining color and appearance consistency is critical for both aesthetic appeal and long-term quality assurance. Variations in aggregate composition, pigment loading, curing conditions, and surface treatments can create noticeable differences in shade or gloss that affect visual uniformity across façades, panels, and site installations. The Agera L2 enables producers to quantify these attributes precisely, ensuring every batch meets visual design intent and specification tolerances.

By establishing baseline CIELAB color and gloss values for approved finishes, manufacturers can continuously monitor production, identify pigment dispersion or curing inconsistencies, and confirm that sealers, curing compounds, or post-treatments do not alter the intended appearance.

HunterLab

Key Benefits

4. Concrete and Pre-Cast Panels

- **Consistent Architectural Appearance**: Quantifies color and gloss to ensure panel-to-panel uniformity in precast façades, pavers, and decorative concrete.
- **Texture-Independent Measurement**: Circumferential geometry averages color over variable aggregate patterns and surface porosity for stable, repeatable data.
- **Rapid Batch Verification**: Enables in-process control of pigment dispersion, curing balance, and finish uniformity.
- **Gloss and Sealant Evaluation**: Detects surface finish changes from curing agents, form-release compounds, or protective sealers.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

HunterLab

Summary

4. Concrete and Pre-Cast Panels

With the Agera L2, concrete producers can ensure **visually consistent panels**, **blocks**, and **architectural elements**, delivering reliable alignment with both the designer's vision and the builder's quality standards—from initial mix design through on-site installation.

Industry Standards & Methods

- ASTM D2244 – Calculation of Color Differences Using .
- ASTM D523 / ISO 2813 – Gloss Measurement at 60°.
- ASTM E1164 / E1349 – Spectrophotometric Color Measurement of Non-Uniform Surfaces.
- ASTM C1549 – Solar Reflectance of Roofing Materials.

HunterLab

HunterLab Advantage

- **0°/45° circumferential optics**: for texture-insensitive accuracy.
- **Simultaneous color + gloss** data collection.
- **Automated UV control**: for solar-reflective and bright-white materials.
- **Large-area view**: for rough or granular samples.
- **High-resolution imaging**: for surface documentation.
- **Seamless Integration with LIMS & SPC Systems**: Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.
- **PC & External Display Connectivity**: Connect via USB to a PC for expanded analysis, long-term storage, or multi-instrument networking. Link to an external display for group training or collaborative QA review.
- **Simplified operation**: Reduces training time and ensures consistent user performance.

Summary

Color defines quality and weathering integrity in roofing and architectural materials. The Agera L2 delivers quantitative appearance data that ensure consistent shade, gloss, and reflectance across production lots, enabling manufacturers to **validate performance** before products ever reach the roof or façade.

HunterLab

3. Chemicals and Minerals

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Chemicals and Mineral Color & Appearance Control

Focus: Dry, Darker, and Irregular Materials

Color measurement in dry chemicals and mineral powders presents unique challenges: non-uniform particle size, surface irregularity, and low reflectance. The Agera L2 overcomes these through a 0°/45° circumferential optical design that averages reflected light from all directions, capturing the true perceived color of course, matte, or granular materials.

HunterLab

Key Application

1. Dark Oxides and Metallic Pigments

In pigment and coatings production, dark oxides and metallic finishes represent some of the most challenging materials to measure accurately. Their low reflectance, high opacity, and complex optical effects–including scattering, absorption, and specular highlights–often exceed the capability of conventional instruments. The Agera L2 delivers precise, repeatable color data across these difficult surfaces, ensuring consistency in visual tone, optical depth, and metallic brilliance.

Key Benefits

1. Dark Oxides and Metallic Pigments

- **High Dynamic Range Measurement**: Detects subtle hue and tone variations in low-reflectance materials, even below 20% reflectance, maintaining accurate ΔE values across gloss levels and particle sizes.
- **Broad Spectral Coverage**: The 360–700 nm range captures full visible response for iron oxide, manganese, carbon, and metallic pigments, accurately representing deep reds, browns, and blacks.
- **True Visual Correlation**: The 0°/45° circumferential geometry eliminates specular reflection, matching human-eye perception of metallic or matte surface finishes.
- **Fluorescence and Oxidation Detection**: UV-included/excluded control isolates photo-reactive, fluorescent, or oxidative changes that affect pigment stability and final appearance.
- **Noise and Stray Light Suppression**: Advanced high-dynamic-range detector minimizes electronic noise, enabling highly stable, repeatable results even on uneven or textured samples.
- **Spectral Trending ,Tolerance Management, Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

1. Dark Oxides and Metallic Pigments

With Agera L2, pigment producers, formulators, and QA laboratories can achieve **precise optical characterization** of even the darkest or most reflective materials—ensuring **visual consistency**, **product reliability**, and **performance integrity** across production batches and global manufacturing sites.

Key Application

2. Mineral Powders and Aggregates

In mining, fillers, and industrial minerals, maintaining consistent color, brightness, and purity is essential to material performance and market value. The Agera L2 is purpose-built for loose powders, granular minerals, and coarse aggregates, where accurate measurement depends on preserving the material's natural light scatter and texture. Its large-area port and flat sample dish allow direct evaluation without compression—eliminating false darkening or hue shifts caused by compaction and ensuring a true correlation between laboratory readings and field appearance.

Key Benefits

2. Mineral Powders and Aggregates

- **Non-Compressed Measurement**: Measures powders and granules in their natural state using a flat-dish holder, preventing color distortion from particle packing or surface flattening.
- **Whiteness and Brightness Control**: Determines ASTM E313 whiteness index for materials such as limestone, kaolin, and talc, ensuring consistency for fillers, coatings, and construction additives.
- **Grade Differentiation**: Tracks ΔE, L*, a*, b* trends to classify iron ore, bauxite, and clay grades, providing objective data on mineral composition and impurity content.
- **Reflectance and Purity Analysis**: Monitors black carbon, graphite, or manganese reflectance to assess purity, oxidation level, and processing efficiency.
- **Texture Averaging Geometry**: The 0°/45° circumferential system averages directional scatter, producing visually correlated data across coarse or irregular particle distributions.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

2. Mineral Powders and Aggregates

With its combination of optical precision and surface-sensitive design, the Agera L2 delivers consistent, reproducible results across even the most challenging mineral substrates–empowering producers to achieve **tighter grade control**, **improved process optimization**, and **globally traceable product certification**.

Key Application

3. Chemical Intermediates and Catalysts

In the manufacture of chemical intermediates, catalysts, and specialty additives, maintaining color stability is critical to verifying purity, reactivity, and performance consistency. The Agera L2 provides a quantitative method to detect and monitor oxidation, hydration, or contamination that can subtly alter color—and signal changes in chemical integrity before they impact product yield or functionality.

Key Benefits

3. Chemical Intermediates and Catalysts

- **Color Stability Tracking**: Monitors Δb^* or Yellowness Index (YI) shifts over time to identify early signs of oxidation, moisture uptake, or discoloration during processing and storage.
- **Photo-Reactivity Detection**: UV-included/excluded modes reveal light- or heat-induced color transformations associated with formulation aging, drying, or catalyst activation.
- **Visual Correlation Geometry**: The 0°/45° circumferential design ensures accurate, human-eye-correlated readings across powders, granules, and irregular particle surfaces.
- **High Dynamic Range Optics**: Maintains precision across materials with variable reflectance, from bright crystalline intermediates to dark metallic catalysts.
- **Process Validation and Traceability**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software for trend analysis, digital recordkeeping, and ISO 9001 or GMP documentation.
- **Batch-to-Batch Consistency**: Enables reliable verification of formulation reproducibility, catalyst activation uniformity, and quality across global production sites.

Summary

3. Chemical Intermediates and Catalysts

By combining optical precision with spectral intelligence, the Agera L2 helps chemical manufacturers maintain **catalyst performance**, **process stability**, and **compliance**—providing a clear, traceable link between color data, chemical quality, and production integrity.

HunterLab

Key Application

4. Fertilizer

In both powdered and granular fertilizer production, uniform color and brightness are critical indicators of chemical stability, coating quality, and process consistency. The Agera L2 provides a precise and visually correlated method for assessing product appearance, ensuring consistent performance and reliable presentation across the agricultural supply chain. Its 0° illumination / 45° circumferential viewing geometry replicates human visual response, while the large-area port captures representative readings across irregular, crystalline, or coated particles.

HunterLab

Key Benefits

4. Fertilizer

- **True Visual Correlation**: 0°/45° circumferential geometry eliminates glare and shadow effects, delivering color data that matches perceived visual appearance.
- **Texture and Particle Averaging**: The 51 mm port averages variations in size, coating thickness, and texture, providing stable results across powders and granules.
- **UV-Controlled Detection**: Identifies brighteners, anti-caking agents, or photo-degradation that alter perceived brightness or hue over time.
- **Moisture and Aging Indicators**: Tracks Δb* and Yellowness Index (YI) shifts that reveal moisture absorption, oxidation, or thermal discoloration during storage.
- **Process Optimization**: Enables operators to fine-tune drying, coating, and blending steps, improving batch uniformity and reducing waste.
- **Digital Traceability**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

4. Fertilizer

With its combination of optical precision, high-repeatability performance, and robust data integration, the Agera L2 helps fertilizer manufacturers **maintain consistent appearance**, **optimized processes**, and trustworthy **brand quality** from production to distribution.

Key Application

5. Powdered Detergents

In powdered detergent production, color consistency reflects chemical balance, stability, and formulation control. The Agera L2 enables manufacturers to measure color directly in bulk powder form—without compaction—ensuring that brightness, whiteness, and hue remain uniform across batches. Its 0°/45° circumferential geometry delivers visually correlated readings across irregular granules and layered particles, while UV-controlled illumination detects brighteners, moisture effects, or degradation before packaging.

Key Benefits

5. Powdered Detergents

- **Direct Powder Measurement**: The flat-dish holder allows measurement without compression, preserving natural scatter and preventing false darkening.
- **Whiteness and Brightener Control**: Quantifies ASTM E313 whiteness index and Δb* for monitoring detergent whiteners, fillers, and blueing agents.
- **Moisture and Oxidation Detection**: Tracks YI and ΔE changes related to humidity absorption, thermal stress, or long-term storage degradation.
- **Texture Averaging**: The large-area 51 mm port captures a representative reading across uneven particle sizes and agglomerates.
- **UV-Included/Excluded Analysis**: Differentiates optical brightener response from chemical discoloration for accurate stability testing.
- **Process Trending and Validation**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer

Summary

5. Powdered Detergents

In powdered detergent manufacturing, color is a key indicator of formulation accuracy, chemical stability, and product quality. The HunterLab Agera L2 enables direct measurement of bulk powders—without compaction—ensuring that brightness, whiteness, and hue remain consistent from batch to batch, enabling precise **process trending**, **quality validation**, and **early detection of formulation or storage issues** before packaging.

HunterLab

Key Application

6. Opaque and Translucent Liquid Detergents

In liquid detergent production, color and appearance are critical indicators of formulation stability, mixing uniformity, and brand identity. The HunterLab Agera L2 accurately measures color in opaque, translucent, or pearlescent liquid detergents, detecting even subtle variations caused by changes in surfactant concentration, dye loading, or phase separation. Its 0° illumination / 45° circumferential viewing geometry replicates human-eye perception, ensuring consistent visual quality across manufacturing and packaging operations. With UV-controlled illumination, the Agera L2 also identifies optical brighteners, dyes, and photo-reactive compounds–helping manufacturers monitor product aging, viscosity variation, and storage stability. Integrated with EasyMatch Essentials software, it provides real-time trending, batch traceability, and digital recordkeeping for complete process control.

Key Benefits

6. Opaque and Translucent Liquid Detergents

- **True Visual Correlation**: 0°/45° circumferential geometry replicates human-eye viewing for both opaque and translucent detergent bases.
- **Phase and Homogeneity Detection**: Identifies color or gloss shifts caused by incomplete blending, surfactant imbalance, or air entrainment.
- **UV-Controlled Measurement**: Detects brighteners, dyes, and photo-reactive compounds, supporting shelf-life and stability testing.
- **Temperature and Aging Sensitivity**: Monitors ΔE changes related to storage, exposure, or viscosity variation over time.
- **Data Consistency and Traceability**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

HunterLab

Summary

6. Opaque and Translucent Liquid Detergents

In liquid detergent manufacturing, maintaining consistent color is essential not only for brand identity but also as a direct reflection of formulation quality and process control. The HunterLab Agera L2 provides manufacturers with a precise, reliable, and visually correlated means of monitoring color stability throughout production, blending, and packaging. Agera L2 is a powerful tool for maintaining **uniform product appearance**, **verifying formulation consistency**, and **reinforcing consumer confidence** in every bottle produced.

HunterLab

Key Application

7. Detergent Pods (Single-Dose Units)

In both powdered and granular fertilizer production, uniform color and brightness are critical indicators of chemical stability, coating quality, and process consistency. The Agera L2 provides a precise and visually correlated method for assessing product appearance, ensuring consistent performance and reliable presentation across the agricultural supply chain. Its 0° illumination / 45° circumferential viewing geometry replicates human visual response, while the large-area port captures representative readings across irregular, crystalline, or coated particles.

HunterLab

Key Benefits

7. Detergent Pods (Single-Dose Units)

- **Multi-Layer Appearance Analysis**: Evaluates color consistency between inner gel and outer capsule, verifying uniform dispersion and separation control.
- **Photo- and Thermal Stability Testing**: UV-included/excluded modes identify dye migration, oxidation, or fading under shelf or heat exposure..
- **Encapsulation Integrity**: Detects subtle hue or gloss variations that may indicate polymer degradation, incomplete sealing, or material imbalance.
- **Visual Uniformity Assurance**: 0°/45° circumferential geometry captures true appearance, even on curved, reflective pod surfaces.
- **Automated Data Management**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.
- .

Summary

7. Detergent Pods (Single-Dose Units)

The HunterLab Agera L2 enables detergent pod manufacturers to achieve precise and repeatable control over product color, transparency, and overall visual appeal—key attributes that directly reflect formulation quality and brand identity. By delivering accurate, visually correlated color data, the Agera L2 helps ensure that every pod within a batch meets exact appearance standards, regardless of differences in dye concentration, encapsulation thickness, or ingredient distribution. Its ability to detect subtle variations in hue, brightness, and optical clarity supports formulation stability, process optimization, and visual uniformity across production runs. Agera L2 gives manufacturers the confidence to release products that meet **global color and appearance specifications**, **reinforcing consumer trust** and **maintaining brand consistency** in highly competitive markets.

Industry Standards & Methods

- ASTM E1164 / E1349 – Color Measurement of Particulate Materials.
- ASTM E313 – Yellowness and Whiteness of Minerals and Chemicals.
- ISO 7724 – Color Measurement for Powders and Pigments.

HunterLab Advantage

- **Large measurement area:** Reduces noise from particle variation.
- **0°/45° optics**: Replicate visual appearance on matte powders.
- **UV control**: Quantifies photo-reactivity and fluorescence.
- **Imaging**: Verifies sample uniformity and texture.
- **Seamless Integration with LIMS & SPC Systems**: Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.
- **Embedded EasyMatch Essentials Software**: Complete On-Board Control. provides full measurement and reporting capability right from the touchscreen.
- **PC & External Display Connectivity**: Connect via USB to a PC for expanded analysis, long-term storage, or multi-instrument networking. Link to an external display for group training or collaborative QA review.
- **Simplified operation**: Reduces training time and ensures consistent user performance.

Summary

For dark, irregular chemicals and minerals, visual assessment is unreliable. Agera L2 provides precise, repeatable data that transform appearance control into a quantitative process parameter – ensuring batch-to-batch consistency and material grade integrity.

4. Denim

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Denim Color Control

The Agera L2 represents a new benchmark in benchtop spectrophotometry, combining 0°/45° circumferential geometry, imaging, and automated UV control in one compact platform. Purpose-built for real-world production and laboratory environments, Agera L2 delivers human-eye-correlated color and gloss data with the precision, stability, and repeatability expected from HunterLab.

HunterLab

Overview

In denim manufacturing, color defines authenticity, quality, and brand identity. From indigo rope dyeing to final fabric finishing, even slight hue differences can create visible mismatches in jeans, jackets, and garments. Traditional visual inspection under varying light conditions cannot ensure shade consistency across batches or suppliers. The HunterLab Agera L2 provides the precision, repeatability, and visual correlation required to achieve consistent color across yarns, ropes, fabrics, and final products.

Using its 0°/45° circumferential geometry, Agera L2 captures the true visual color of denim, accounting for the complex interplay between indigo dye layers, surface texture, and fabric weave. It excludes glare from glossy fibers, measures over large sample areas, and provides ΔE, L*, a*, b* values that correspond directly to human visual perception.

HunterLab

Key Application

1. Denim Fabric (Rolls, Panels, and Garments)

In denim manufacturing, maintaining consistent color across fabric rolls, finishing batches, and garment lots is critical for predictable shading and wash performance. The Agera L2 provides rapid, non-destructive, and visually correlated color measurement, ensuring that every roll and garment meets specification before cutting or assembly. Its 0° illumination / 45° circumferential geometry captures the true appearance of textured denim fabrics, averaging out twill patterns, slubs, and surface irregularities to deliver stable, repeatable results that mirror human visual perception.

Key Benefits

1. Denim Fabric (Rolls, Panels, and Garments)

- **Batch Shade Control**: Track dye uniformity and fade tendency by monitoring ΔE trends throughout dyeing, drying, and finishing processes to maintain consistent lot-to-lot coloration.
- **Finishing and Washing**: Quantify brightness and tone changes caused by enzyme, stone, ozone, or bleach washing operations to verify controlled fading and visual appeal.
- **Supplier Alignment**: Use objective color data to synchronize standards between weaving mills, garment manufacturers, and brand QA teams, ensuring global production alignment.
- **Texture Averaging**: The circumferential geometry and large 51 mm port minimize the effects of twill weave, slubs, or raised surfaces, providing stable, human-eye-correlated measurements across various denim styles.
- **Process Validation**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

1. Denim Fabric (Rolls, Panels, and Garments)

The HunterLab Agera L2 transforms the traditionally subjective process of evaluating denim color and texture into precise, quantifiable data that manufacturers can measure, track, and reproduce with confidence. By converting appearance into objective color values, the Agera L2 allows denim producers to maintain tight control over shade uniformity across rolls, panels, and finished garments—an essential factor for both quality assurance and brand consistency. This level of precision helps **eliminate costly waste** from off-shade or mismatched lots, **supports process optimization during dyeing and finishing**, and **enables consistent communication of color specifications throughout the global supply chain**. The result is **improved production efficiency**, reduced rework, and denim products that **consistently meet the aesthetic and performance expectations** of both brands and consumers.

HunterLab

Key Application

2. Denim Rope (Warp Yarns and Indigo Dyeing)

Rope dyeing is the core of denim production—and the most color-critical stage in achieving consistent shade and wash performance. During this process, multiple yarn bundles are repeatedly immersed in indigo or sulfur dye baths, when subtle variations in oxidation, dye concentration, or chemical balance can produce visible differences in the final fabric. The Agera L2 provides precise, non-destructive color measurement for both laboratory and production environments, ensuring that dyed yarns meet defined shade standards before weaving.

Key Benefits

2. Denim Rope (Warp Yarns and Indigo Dyeing)

- Rope Shade Monitoring: Measure indigo tone consistency across dyed ropes to verify bath equilibrium, oxidation uniformity, and chemical balance throughout the dyeing cycle.
- Process Optimization: Detect spectral shifts that indicate under-oxidation, chemical imbalance, or bath depletion before defects carry forward into weaving and finishing.
- Bundle Averaging: The large 51 mm measurement port captures representative color data across multiple yarns simultaneously, reducing variability caused by yarn position, twist, or tension.
- Pre-Weaving Verification: Confirm that dyed rope shade matches the target standard before loading into the loom—preventing large-scale shade variation in woven denim.
- Data Integration and Reporting: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

2. Denim Rope (Warp Yarns and Indigo Dyeing)

The HunterLab Agera L2 brings laboratory-grade precision to the critical stages of denim rope and warp yarn dyeing, where consistent indigo tone, saturation, and penetration define final fabric quality. By integrating Agera L2's accurate, visually correlated color data with inline process feedback systems, manufacturers can monitor and adjust dye bath conditions in real time—optimizing parameters such as temperature, pH, and dwell time for maximum dye efficiency. This proactive control minimizes variation between warp bundles, reduces chemical and water waste, and eliminates costly reprocessing caused by off-shade or uneven coloration. The result is **uniform, high-quality denim** that **meets tight aesthetic and performance standards** while **improving process sustainability** and **production throughput** across the entire dyeing operation.

Key Application

3. Denim Finishing and Brand Consistency

In premium and fashion denim markets, maintaining a signature brand shade across global suppliers and manufacturing partners is essential to visual identity and consumer trust. The Agera L2 quantifies color with exceptional precision and high repeatability ($\Delta E \leq 0.02$), providing imaging verification of each measurement area to document shade uniformity and appearance consistency. This combination of quantitative color data and visual validation ensures full traceability throughout the denim finishing process–from dyeing to garment wash.

HunterLab

Key Benefits

3. Denim Finishing and Brand Consistency

- **Establish Master Shade Standards**: Define and manage brand-specific color tolerances across all global production and finishing sites.
- **Audit Color Consistency**: Objectively evaluate color across mills, laundries, and subcontractors, ensuring alignment with approved reference standards.
- **Assess Wash and Fade Performance**: Quantify post-wash, enzyme, or abrasion-induced color shifts to confirm controlled, repeatable finishing effects that match design intent.
- **Verify Visual Uniformity**: Integrated imaging capability records the measured area, providing visual confirmation of surface texture, stitch contrast, or distressing uniformity.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

3. Denim Finishing and Brand Consistency

By converting subjective appearance into measurable, reproducible data, the Agera L2 ensures that every garment – whether from a local production run or an international supplier – aligns precisely with the intended brand identity, supporting consistent presentation, consumer confidence, and premium product perception.

Industry Standards & Methods

- ASTM E1164 / E1349 – Standard Practices for Spectrophotometric Reflectance Measurement of Textile Surfaces.
- ISO 7724 1/2/3 – Color Measurement for Dyes, Pigments, and Dyed Fabrics 45°/0° Geometry).
- AATCC 173 – Reflectance Measurements for Textiles.
- CIELAB – Standard Color Space for Visual Correlation in Textile Color Management. These standards provide the foundation for traceable, repeatable color communication from dye house to finished garment.

HunterLab Advantage

Agera L2 is engineered to meet the color-control demands of modern denim production.

- **0°/45° Circumferential Geometry**: Captures reflected color as the eye perceives it while minimizing glare from glossy fibers.
- **Large 51 mm Measurement Port**: Averages over multiple yarns or fabric threads for stable readings on textured denim and rope bundles.
- **Automated UV Control**: Detects and quantifies the effect of optical brighteners, finishing agents, or sulfur additives.
- **High-Resolution Imaging**: Provides visual confirmation of the measurement area to verify fabric uniformity.
- **Compact and Intuitive**: Streamlined operation supports both laboratory technicians and mill operators in production environments.
- **Proven Repeatability**: ΔE 0.02 ensures global consistency across dye lots, suppliers, and manufacturing facilities.
- **Seamless Integration with LIMS & SPC Systems**: Plug-and-play connection via Ethernet or USB– no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.

Summary

Color is the defining language of denim. From the indigo rope that begins the process to the finished garment on the shelf, every stage depends on precise, consistent shade control. The HunterLab Agera L2 provides the technology to make that control measurable.

With its 0°/45° circumferential geometry, UV-controlled illumination, large measurement area, and imaging verification, Agera L2 captures the true appearance of denim as the human eye perceives it. It delivers the consistency, speed, and confidence needed to align shade standards across mills, brands, and garment producers worldwide.

Whether ensuring indigo rope uniformity, maintaining roll-to-roll color integrity, or protecting brand identity in premium denim, Agera L2 sets a new standard for instrumental color measurement in the denim industry.

5. Paint and Coatings

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Paint and Coating Color Control

The Agera L2 represents a new benchmark in benchtop spectrophotometry, combining 0°/45° circumferential geometry, integrated 60° gloss measurement, imaging, and automated UV control in one compact platform. Purpose-built for real-world production and laboratory environments, Agera L2 delivers human-eye-correlated color and gloss data with the precision, stability, and repeatability expected from HunterLab.

Overview

In the world of paints and coatings—whether architectural, industrial, or coil—the appearance of the final finish defines quality, performance, and brand value. Color, gloss, and surface texture must align precisely to meet specifications and ensure that coatings look and perform as designed. Even minor hue or gloss variations can result in rework, warranty claims, or aesthetic failure once panels are installed side by side.

The HunterLab Agera L2 provides the complete laboratory solution for quantifying color and appearance in coatings. Its 0°/45° circumferential geometry replicates how the human eye perceives color on reflective surfaces, while the integrated 60° glossmeter and imaging camera capture gloss and surface texture simultaneously.

With automated UV control and a large 51 mm 2-inch measurement port, Agera L2 delivers consistent, traceable results across matte, satin, and high-gloss finishes—without the need for specialized sample holders.

Key Application

1. Architectural and Protective Coatings

The Agera L2 provides precise, objective measurement of color and gloss for architectural, industrial, and protective coatings, enabling manufacturers to ensure long-term consistency and performance across buildings, bridges, and infrastructure applications. Its 0° illumination / 45° circumferential viewing geometry eliminates specular reflection and replicates human visual response, while integrated 60° gloss measurement delivers complete appearance analysis in a single reading. Results are fully traceable and compliant with ASTM D2244 (color difference) and ASTM D523 (gloss), providing data alignment between the laboratory, production floor, and job site.

HunterLab

Key Benefits

1. Architectural and Protective Coatings

- Color Matching: Maintain RAL, NCS, or custom corporate color standards across production batches, coating lines, and field applications to ensure brand and project consistency.
- Film Uniformity: Detect variations in pigment dispersion, coating thickness, or curing through measurable L*, a*, b* and gloss unit (GU)** trends for real-time process control.
- Surface Texture Analysis: Integrated imaging capability captures flow, leveling, and orange-peel defects invisible to conventional instruments, linking quantitative data to visual appearance for complete aesthetic evaluation.
- Environmental Durability: Track ΔE and YI changes after UV, humidity, or salt-spray exposure to verify color stability and coating performance.
- Specification Compliance: Objective, traceable data simplify color communication between coating suppliers, applicators, and project managers, ensuring contractual appearance requirements are met.
- Data Integration and Reporting: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

1. Architectural and Protective Coatings

The HunterLab Agera L2 delivers exceptional precision and visual correlation for architectural and protective coatings, where both aesthetics and durability define product success. By integrating numeric color, gloss, and imaging data that directly correspond to human visual perception, the Agera L2 enables manufacturers, formulators, and specifiers to achieve consistent color harmony and surface appearance across batches, substrates, and coating systems. Its ability to quantify subtle variations in hue, gloss, and texture ensures that painted and coated surfaces meet rigorous design and performance standards–from decorative wall paints to industrial corrosion-resistant finishes. Through enhanced process control and traceable data, the Agera L2 **supports long-term product reliability**, **reduces costly rework**, and **reinforces confidence in every applied finish**–whether on building facades, infrastructure, or heavy equipment coatings.

Key Application

2. Industrial Coatings

Industrial coatings applied to machinery, flooring, fabricated metal, and equipment housings require rigorous control of appearance, performance, and durability to ensure both functional protection and consistent visual quality. The Agera L2 integrates color, gloss, and imaging measurement in a single reading, providing manufacturers with quantitative data for formulation control, batch verification, and process optimization. Its 0° illumination / 45° circumferential geometry replicates human-eye response while minimizing the effects of gloss and texture variation common to industrial coatings.

Key Benefits

2. Industrial Coatings

- Powder and Liquid Systems: Quantify ΔE_{00} color difference and gloss to monitor cure temperature, pigment load, and crosslinking, ensuring consistent coating appearance and adhesion performance.
- Matte vs. Gloss Finishes: Distinguish texture-induced gloss variation from true color shifts, allowing precise adjustment of curing profiles or additive levels to achieve the desired finish.
- Process Optimization: Rapid, repeatable readings during in-process and QA checks reduce rework, ensure inter-batch uniformity, and maintain compliance with appearance specifications.
- Durability and Performance Tracking: Evaluate ΔE and YI changes after environmental or chemical exposure to validate coating resistance and aging stability.
- Standardized Data Alignment: Supports ASTM D2244 (color) and ASTM D523 (gloss) methodologies for consistent global quality documentation.
- Data Integration and Reporting: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

HunterLab

Summary

2. Industrial Coatings

The HunterLab Agera L2 provides a comprehensive and efficient solution for industrial coating manufacturers and applicators seeking to maintain consistent appearance, quality, and performance across a wide range of coating systems. Its combination of high-speed measurement, UV-controlled illumination, and integrated gloss and imaging analysis enables precise evaluation of both color and surface characteristics in real time. This ensures that coatings applied to metals, plastics, and composites meet stringent visual and functional standards under diverse production conditions. By capturing quantitative data that correlates directly with human visual assessment, the Agera L2 supports **tighter process control**, **faster quality verification**, and r**educed variability between batches and application lines**. The result is **improved production efficiency**, **enhanced coating durability,** and **uniform, on-brand visual performance** across global manufacturing operations.

HunterLab

Key Application

3. Coil and Appliance Coatings

For coil and appliance production lines, where color tolerances are exceptionally tight, even differences as small as ΔE_{00} = 0.5 can determine product acceptability. The Agera L2 serves as the laboratory reference standard, enabling precise correlation between inline, laboratory, and field measurements. Its 0° illumination / 45° circumferential viewing geometry delivers visually correlated color data, while integrated 60° gloss measurement ensures that both tone and finish remain within required tolerances throughout coating and curing operations.

Key Benefits

3. Coil and Appliance Coatings

- **Layer Interaction**: Measure color and gloss of primer, topcoat, and clear layers to confirm uniform appearance and interlayer adhesion consistency.
- **Gloss Drift Detection**: Identify deviations caused by oven temperature, solvent ratios, or resin mix changes that can alter surface reflectance or coating texture.
- **Surface Imaging**: Detect micro-texture, flow, or leveling defects—such as mottle or micro-blush—that affect light scatter and panel-to-panel match.
- **Cross-Line Alignment**: Ensure consistent shade, gloss, and appearance across multiple coating lines and global facilities under ASTM D2244 (color difference) and NCCA Technical Bulletin 404 gloss tolerances.
- **Process Validation**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

3. Coil and Appliance Coatings

In coil and appliance coating lines where color tolerances are extremely tight (often within $\Delta E_{00} = 0.5$), the HunterLab Agera L2 provides laboratory-grade precision for maintaining consistent color and gloss. Its 0° illumination / 45° circumferential viewing geometry and integrated 60° gloss measurement deliver visually correlated data that aligns laboratory, inline, and field results. The Agera L2 detects gloss drift, monitors layer interactions, and identifies surface texture or flow defects, ensuring uniform appearance across coatings and facilities. With EasyMatch Essentials software for ΔE tracking, trend analysis, and traceability, it supports compliance with ASTM D2244 and NCCA Bulletin 404, simplifying process validation and quality documentation.

Industry Standards & Methods

- ASTM D2244 – Calculation of Color Differences Using Coordinates.
- ASTM D523 / ISO 2813 – Specular Gloss Measurement.
- ASTM E1164 / E1349 – Standard Practices for Spectrophotometric Color Measurement.
- ASTM D1003 – Haze and Clarity for Transparent or Semi-Gloss Coatings.
- ISO 7724 1/2/3 – Color Measurement of Paints and Enamels Using 0°/45° Geometry. These globally recognized standards ensure that Agera L2 results correlate directly with human visual assessment and can be compared across instruments and facilities.

HunterLab Advantage

Agera L2 integrates the essential elements of modern color science into a single, intuitive platform:

- 0°/45° Circumferential Geometry: Captures color as the human eye perceives it, excluding specular reflection.
- Integrated 60° Glossmeter: Measures gloss simultaneously with color to define appearance comprehensively.
- Automated UV Control: Accurately measures coatings containing fluorescent or optically brightened pigments.
- High-Resolution Imaging: Provides visual confirmation of measurement area and texture uniformity.
- Large 51 mm Port Plate: Averages over larger sample areas, ideal for textured, matte, or metallic finishes.
- Data Integration and Reporting: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.
- Seamless Integration with LIMS & SPC Systems: Plug-and-play connection via Ethernet or USB– no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.

Summary

Color and appearance define success in the coatings industry. The HunterLab Agera L2 delivers unmatched accuracy, speed, and confidence by quantifying both color and gloss in one instrument. From architectural paints to high-performance industrial and coil coatings, it provides a complete analytical solution that mirrors human visual perception while meeting ASTM and ISO standards.

With Agera L2, manufacturers can control every aspect of visual performance–color, gloss, and texture–ensuring each coating meets specification, reduces waste, and reinforces brand consistency.

It's not just a color measurement tool; it's a complete appearance control platform for the next generation of coatings quality assurance.

6. Paper

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Paper & Coated Paper Color & Appearance Control

Focus: Fluorescent Whitening Agents and Surface Texture

Paper color and appearance define quality, brightness, and print performance. Fluorescent Whitening Agents FWAs and coatings make precise UV control essential for accurate measurement. The Agera L2, with its broad 360 700 nm spectral range and automated UV-included/excluded illumination, provides laboratory-grade data that mirror human visual response to brightened and coated papers.

Key Application

1. Coated and Uncoated Papers

The Agera L2 delivers exceptional precision for color and appearance control in coated and uncoated papers, ensuring consistency from initial production through end-use performance. Paper appearance depends on brightness, shade uniformity, gloss balance, and long-term stability—all of which directly affect perceived quality and printability. The Agera L2 provides the quantitative insight needed to manage these variables across coating, calendaring, and finishing stages, transforming subjective evaluation into traceable, repeatable data.

HunterLab

Key Benefits

1. Coated and Uncoated Papers

- **Standardized Color Tolerances**: Establish and monitor numerical ΔE limits across pre-treatment, post-coating, and after-aging conditions to ensure uniformity throughout processing.
- **Shade and Gloss Balance**: Simultaneously evaluate color and surface gloss to verify coating uniformity between production lots.
- **UV-Controlled Brightness Evaluation**: Measure and quantify optical brightening agents (FWAs) under UV-included and UV-excluded conditions to confirm brightness consistency and regulatory compliance.
- **Aging and Stability Monitoring**: Track ΔE and YI trends to assess paper stability, yellowing, or brightness loss from light exposure and environmental effects.
- **Comprehensive Appearance Insight**: Integrated 0°/45° geometry with 60° gloss and imaging provides complete correlation to human visual assessment.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

1. Coated and Uncoated Papers

By combining optical precision, UV control, and integrated gloss measurement, the Agera L2 enables paper manufacturers and converters to maintain consistent brightness, shade balance, and surface finish across production stages and material types. Its quantitative data replaces subjective inspection with traceable, repeatable color standards, ensuring that every coated and uncoated grade meets visual, regulatory, and performance expectations—from mill production to end-use printing and packaging applications.

Key Application

2. Printing and Packaging Paper

The Agera L2 provides comprehensive color and appearance evaluation for printing and packaging grades, where precise color reproduction and surface finish control are essential for brand consistency and visual appeal. By combining 0°/45° circumferential geometry with integrated 60° gloss measurement, it enables printers and packaging converters to correlate instrumental data directly with human visual perception—ensuring accurate proof-to-press and batch-to-batch matching across substrates, coatings, and ink systems.

Key Benefits

2. Printing and Packaging Paper

- **Visual Correlation for Proof Approval**: Align ΔE, L*, a*, b* color values with visual acceptance standards to confirm press proofs and production runs meet brand specifications.
- **Surface Finish Verification**: Evaluate color and ink absorption balance across matte, semi-gloss, and high-gloss substrates to maintain consistent print quality.
- **Distinguish Gloss vs. Pigment Variation**: Simultaneous color and gloss measurement differentiates hue changes caused by surface sheen from those due to pigment or formulation differences.
- **Substrate and Coating Compatibility**: Assess how coatings, varnishes, and laminates affect perceived color, brightness, and saturation.
- **Data Integrity and Traceability**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

Summary

2. Printing and Packaging Paper

The HunterLab Agera L2 empowers printing and packaging professionals to achieve precise, repeatable, and visually consistent color across every stage of production. By integrating color, gloss, and imaging measurement within a single compact system, the Agera L2 transforms subjective visual inspection into objective, quantifiable data that directly correlates with human perception. This capability allows operators and brand owners to **verify color accuracy**, **monitor gloss variation**, and **detect surface inconsistencies** in real time—ensuring that every printed substrate, film, or package aligns with defined brand standards. The result is **faster press approvals**, **fewer costly reprints**, and **stronger color integrity across substrates, finishes, and global print locations**. With the Agera L2, packaging teams can maintain full control of visual quality from design through final production, ensuring a consistently premium, brand-true appearance.

Key Application

3. Tissue Paper

The HunterLab Agera L2 sets a new standard for appearance evaluation in tissue manufacturing, where visual quality directly influences consumer perception of softness, cleanliness, and premium value. Tissue products–ranging from facial tissue and napkins to bath tissue and towels–must maintain consistent whiteness, brightness, and surface tone across large production volumes. The Agera L2's advanced optical system, UV-controlled illumination, and large-area sampling port make it ideal for capturing subtle optical and textural variations that affect appearance. By providing precise, repeatable, and traceable color data, it allows manufacturers to maintain tight process control, optimize brightener and filler usage, and uphold uniform visual standards across every production lot.

Key Benefits

3. Tissue Paper

- **Consistent Whiteness and Brightness:** Quantifies color and optical brightener effects for visual uniformity across lots.
- **UV-Controlled Illumination:** Differentiates natural fiber tone from brightener performance or yellowing.
- **Large-Area Sampling:** Averages texture and pattern variations in embossed or multilayer tissue.
- **Process Stability Monitoring:** Tracks ΔE and whiteness index changes due to humidity, heat, or fiber variation.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

HunterLab

Summary

3. Tissue Paper

With its precise, visually correlated measurement capabilities, the Agera L2 empowers tissue producers to achieve unmatched color uniformity and process reliability. By reducing off-shade rolls, minimizing waste, and ensuring compliance with brand-specific appearance targets, the instrument helps manufacturers **enhance operational efficiency** and **deliver a consistently bright, soft, and clean visual impression that strengthens brand loyalty and consumer satisfaction worldwide.**

Key Application

4. Recycled Paper

In recycled paper manufacturing, maintaining color and brightness consistency across diverse fiber sources is a major challenge. Variations in post-consumer content, ink residue, and bleaching performance can all impact appearance. The HunterLab Agera L2 delivers the precision and stability required to monitor these variables with confidence. Its UV-controlled illumination differentiates between optical brightener response and natural pulp color, while its high-sensitivity optics accurately measure ISO brightness, whiteness index, and hue. The result is a clear, objective understanding of product appearance that enables tighter process control, better blending of recycled materials, and improved customer satisfaction through consistent, high-quality paper output.

HunterLab

Key Benefits

4. Recycled Paper

- **Accurate Brightness Evaluation:** Measures ISO brightness and YI to assess optical and chemical bleaching effects.
- **Contamination Detection:** Identifies visual discoloration or specking caused by ink, adhesive, or fiber residue.
- **UV-Enhanced Differentiation:** Distinguishes optical brightener response from inherent pulp color.
- **Batch Uniformity Assurance:** Tracks color stability across recycled fiber sources and production runs.
- **Quality Verification:** Generates quantitative data for compliance, certification, and customer reporting.
- **Data Integration and Reporting**: Embedded EasyMatch Essentials 2.0 and EasyMatch Quality Central PC based software provide automated trend charts, tolerance tracking, and documentation for product validation and customer assurance.

HunterLab

Summary

4. Recycled Paper

The Agera L2 enables recycled paper manufacturers to balance sustainability with visual quality, ensuring every lot meets appearance and performance standards. By converting subjective evaluation into objective, traceable metrics, it enhances quality consistency, reduces rework, and strengthens customer confidence in recycled materials. Through its advanced optics, UV control, and intelligent software integration, the Agera L2 **supports the paper industry's shift toward environmentally responsible production—without compromising on visual excellence or product integrity.**

HunterLab

Industry Standards & Methods

- ISO 2470 – Brightness of Paper ISO Brightness.
- ISO 11475 – UV Content and CIE Whiteness for Paper with Fluorescence.
- TAPPI T452/T560 – Brightness and Whiteness Measurement of Paper.
- ASTM E313 – Yellowness Index for Paper and Pulp.

HunterLab Advantage

- Automated UV control: for FWA quantification and aging analysis.
- Integrated gloss measurement: for coated paper appearance.
- Large port: averages fiber and coating irregularities.
- Imaging: ensures spot uniformity and defect documentation.
- Seamless Integration with LIMS & SPC Systems: Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.
- Embedded EasyMatch Essentials Software: Complete On-Board Control. provides full measurement and reporting capability right from the touchscreen.
- PC & External Display Connectivity: Connect via USB to a PC for expanded analysis, long-term storage, or multi-instrument networking. Link to an external display for group training or collaborative QA review.
- Simplified operation: Reduces training time and ensures consistent user performance.

Summary

The Agera L2 enables paper manufacturers, converters, and printers to maintain precise control over brightness, whiteness, and gloss–critical factors in perceived quality and print consistency. Its UV-controlled illumination isolates FWA response, ensuring color data match what consumers see under real lighting.From coated board to lightweight tissue, Agera L2 delivers the repeatable, human-eye-correlated appearance data that define excellence in the paper industry.

HunterLab

7. Plastics

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Plastics Manufacturing

The Agera L2 represents a new benchmark in benchtop spectrophotometry for Plastics Manufacturing, combining 0°/45° circumferential geometry, integrated 60° gloss measurement, imaging, and automated UV control in one compact platform. Purpose-built for real-world production and laboratory environments, Agera L2 delivers human-eye-correlated color and gloss data with the precision, stability, and repeatability expected from HunterLab.

HunterLab

Overview

In the plastics industry, color defines quality, purity, and brand recognition. From natural polyethylene pellets to optically brightened resins and pigmented masterbatches, color variation can signal formulation drift, contamination, or thermal degradation. The Agera L2 provides the definitive color measurement solution for opaque, translucent, and slightly transparent plastics where human visual correlation, gloss control, and UV response are essential.

With its 0°/45° circumferential geometry, the Agera L2 measures color the same way people perceive it – excluding glare, capturing true surface color, and delivering consistent readings across textured, glossy, or patterned materials. Its built-in glossmeter and imaging camera combine to give a complete picture of color and surface appearance in one step.

Key Application

1. Resins and Pellets

Agera L2 excels at evaluating the color, brightness, and optical appearance of plastic resins and pellets without requiring pressing, melting, or additional preparation. Its large 51 mm (2-inch) XLAV port captures a representative average across thousands of pellets, ensuring accurate and highly repeatable measurements for every resin type–from natural to masterbatch to recycled blends. The 0°/45° circumferential geometry provides visually correlated results, enabling quality teams to detect even subtle tone or brightness shifts that affect final product appearance and process control.

Key Benefits

1. Resins and Pellets

- Virgin and Natural Resins: Monitor yellowness (ASTM E313 YI) to detect early signs of oxidation, thermal degradation, or contamination during processing or storage.
- Colored and Masterbatch Pellets: Quantify pigment concentration and dispersion uniformity to ensure consistent batch approval and minimize lot-to-lot color variation.
- Optically Brightened Resins: Use automated UV-included/excluded modes to measure fluorescent response and confirm proper brightener dosage and distribution.
- Recycled and Blended Materials: Track ΔE, L*, a*, b*, and YI values to maintain consistent tone and whiteness when combining post-consumer and virgin content, supporting sustainability initiatives without compromising quality.
- High-Throughput Precision: The large-aperture design and EasyMatch Essentials software enable rapid averaging of multiple readings for statistically robust results and digital traceability.

HunterLab

Summary

1. Resins and Pellets

With its combination of large-area sampling, UV control, and visual correlation, the Agera L2 provides a fast, non-destructive, and repeatable method for managing resin color and appearance—helping manufacturers maintain product consistency, verify pigment loading, and support continuous quality improvement across the plastics value chain.

Key Application

2. Opaque and Textured Products

The Agera L2 delivers precise and visually correlated measurement of opaque and textured materials, capturing both color and surface appearance in a single reading. Designed for injection-molded components, extruded sheets, and coated films, the Agera L2's 0° illumination / 45° circumferential viewing geometry eliminates specular reflection while replicating human visual response—making it the ideal choice for evaluating textured or patterned surfaces where gloss and color interact.

Key Benefits

2. Opaque and Textured Products

- **Comprehensive Appearance Measurement**: Simultaneously quantifies color, gloss, and texture influence, ensuring visual consistency across molded or extruded parts.
- **Texture-Independent Accuracy**: Circumferential geometry averages directional scatter from surface texture, embossing, or grain, providing stable readings across varying finishes.
- **Versatile Material Coverage**: Suitable for vinyl siding, automotive interiors, appliance housings, flooring, and consumer electronics where both tone and texture define perceived quality.
- **Color Control for Complex Surfaces**: Distinguishes hue variation from gloss differences, enabling precise process adjustments during molding or coating.
- **Reliable, Repeatable Data**: The Agera L2's high-dynamic-range detector and large-area port ensure consistent results across smooth, matte, and textured samples.

Summary

2. Opaque and Textured Products

By integrating color and appearance measurement into one step, the Agera L2 provides manufacturers with a powerful, objective tool for maintaining uniformity, reducing rework, and verifying aesthetic quality in products where surface finish and visual harmony are critical to brand and performance.

Key Application

3. Plastic Sheet

The Agera L2 provides manufacturers of opaque extruded plastic sheet with precise, repeatable measurement of color and surface appearance, ensuring visual consistency across production runs and product grades. Variations in polymer formulation, pigment load, or surface texture can create perceptible differences in shade or gloss that affect both quality perception and downstream applications such as thermoforming, printing, or lamination. The Agera L2's 0° illumination / 45° circumferential viewing geometry captures color exactly as it appears to the human eye—eliminating specular reflection while averaging surface texture for true visual correlation.

Key Benefits

3. Plastic Sheet

- **Process Color Control**: Quantify CIELAB values and ΔE trends to maintain color uniformity across extruder lines, cooling rolls, and finish textures.
- **Texture Averaging**: Circumferential geometry ensures consistent measurement on matte, embossed, or patterned sheet surfaces without influence from directional gloss.
- **Gloss and Appearance Balance**: Integrated 60° gloss measurement correlates color and reflectance to verify finish uniformity and identify coating or surface anomalies.
- **Material and Additive Validation**: Detect shade shifts from regrind content, UV stabilizers, or pigment concentration variations to ensure formulation consistency.
- **Quality Data Integration**: EasyMatch Essentials software enables trend monitoring, tolerance management, and digital recordkeeping for LIMS and SPC systems.

Summary

3. Plastic Sheet

By combining color, gloss, and texture evaluation in a single, non-destructive measurement, the Agera L2 empowers producers of opaque extruded plastic sheet to achieve precise visual alignment, optimize process control, and deliver consistent, high-quality materials for packaging, building, and industrial applications.

Key Application

4. Vinyl Siding

The Agera L2 delivers precise, repeatable measurement of color and gloss for vinyl siding, ensuring consistent appearance across production lots, extrusion lines, and long-term outdoor exposure. Because vinyl siding color and finish are influenced by formulation, surface texture, and gloss level, even small variations can affect consumer perception and fail to meet industry color standards. The Agera L2's 0° illumination / 45° circumferential viewing geometry provides visually correlated data by eliminating specular reflection and averaging directional scatter–ideal for evaluating textured or embossed siding profiles where appearance consistency is critical.

Key Benefits

4. Vinyl Siding

- **Color Uniformity Control**: Quantify CIELAB color values and ΔE differences to maintain uniform tone and shade across extrusion runs, molds, and suppliers.
- **Texture and Finish Averaging**: Circumferential geometry ensures accurate readings on woodgrain or matte textures, providing stable, reproducible results independent of pattern direction.
- **Gloss and Appearance Integration**: Integrated 60° gloss sensor correlates reflectance with visual perception, verifying that gloss and color remain within defined tolerances.
- **Weathering and Fade Resistance**: ΔE, L*, a*, b*, YI, and gloss changes after accelerated UV or outdoor exposure to confirm long-term color stability and performance.
- **Additive and Resin Verification**: Detect subtle hue shifts caused by TiO_2, stabilizers, or regrind content, supporting consistent formulation and product quality.

Summary

4. Vinyl Siding

By combining color, gloss, and texture evaluation into a single measurement, the Agera L2 enables vinyl siding manufacturers to standardize appearance, verify weathering performance, and ensure every profile meets industry standards such as ASTM D2244 and D523 –delivering enduring visual quality and brand confidence in every installation.

HunterLab

Key Application

5. Profile Extrusion – Windows, Moldings, and Trim

The Agera L2 provides high-precision, visually correlated color and gloss measurement for extruded profiles such as window frames, door moldings, architectural trim, and PVC components. Profile extrusion presents unique appearance challenges due to differences in cooling rate, surface finish, and resin composition across line speeds and tooling. The Agera L2's 0° illumination / 45° circumferential viewing geometry eliminates specular reflection while averaging directional scatter, delivering accurate, repeatable readings even on curved, grooved, or textured profiles.

Key Benefits

5. Profile Extrusion – Windows, Moldings, and Trim

- **Color Consistency Across Profiles**: Quantify CIELAB and ΔE values to maintain shade and brightness uniformity between runs, molds, and product families.
- **Gloss and Surface Finish Control**: Integrated 60° gloss measurement ensures balanced appearance between matte and semi-gloss finishes, critical for visible architectural components.
- **Texture Averaging**: Circumferential geometry captures representative results over woodgrain embossing, brushed finishes, or micro-textured surfaces without directional bias.
- **Material and Formulation Verification**: Detect subtle color or gloss shifts caused by additive concentration, pigment loading, or regrind use to ensure batch-to-batch consistency.
- **Compliance and Data Integrity**: EasyMatch Essentials software supports ASTM D2244 (color) and ASTM D523 (gloss) alignment, providing full digital traceability for quality certification and customer audits.

Summary

5. Profile Extrusion – Windows, Moldings, and Trim

By integrating color, gloss, and surface evaluation in one step, the Agera L2 empowers profile extruders to maintain precise aesthetic standards across complex geometries—ensuring that every window frame, molding, and trim component achieves consistent appearance, durability, and brand integrity from production to installation.

HunterLab

Industry Standards & Methods

- ASTM E1164 – Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation.
- ASTM E1349 – Reflectance Measurement for Plastics and Pigments using Spectrophotometers.
- ASTM E313 – Whiteness and Yellowness Index for Plastics.
- ASTM D6290 – Color Measurement of Pelletized Plastics.
- ASTM D523 / ISO 2813 – 60° Specular Gloss Measurement.

HunterLab Advantage

The Agera L2 transforms plastic color evaluation by combining technologies previously available only through multiple instruments.

- **0°/45° Circumferential Geometry:** Replicates the human visual response for true color evaluation of solid and textured surfaces.
- **Integrated 60° Gloss Measurement:** Simultaneously reports color (CIELAB, ΔE) and gloss GU) in a single reading, reducing analysis time and error.
- **Imaging Capability:** Captures the measurement spot to confirm surface homogeneity and document defects or texture effects.
- **Automated UV Control:** Detects and quantifies optical brighteners or UV absorbers in resins, ensuring stable performance under different lighting conditions.
- **Large Aperture Port 51 mm:** Provides superior averaging on non-uniform samples such as pellets or matte finishes.
- **Compact Design + Touchscreen Interface:** Simplifies operation for lab technicians and production operators alike.
- **Seamless Integration with LIMS & SPC Systems:** Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and

Summary

Color quality in plastics is more than aesthetics, it signals process consistency, formulation accuracy, and product reliability. The Agera L2 from HunterLab delivers comprehensive color and appearance data that mirror human vision while meeting the strictest industry standards. From resin and pellet evaluation to finished parts inspection, Agera L2 simplifies workflows and provides immediate, actionable insight into material quality.

With Agera L2, manufacturers gain the confidence to release products faster, reduce scrap from off-shade batches, and strengthen supplier alignment through objective data. It is the single-instrument solution for plastics color control in an industry that demands accuracy, repeatability, and speed.

8. Textiles Laundering

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Textile Laundering Color & Appearance Control

The Agera L2 represents a new benchmark in benchtop spectrophotometry, combining 0°/45° circumferential geometry, integrated 60° gloss measurement, imaging, and automated UV-control modes in one compact platform. Purpose-built for textile producers and finishers, the Agera L2 delivers human-eye-correlated color and appearance data with the precision, stability, and repeatability expected from HunterLab.

HunterLab

Overview

In textile manufacturing, laundering and UV exposure are two of the most common sources of color and appearance degradation. Fabrics may fade, change tone, or lose brightness after repeated washes or prolonged sun exposure. For brands, mills, and finishers, managing this shift is critical to maintaining consistency, meeting customer expectations, and reducing returns. The Agera L2 provides a powerful analytical tool to quantify these changes – both in terms of hue and brightness as well as surface appearance – so that laundering processes, UV-resistant finishes, and maintenance protocols can be controlled and validated.

Key Application

1. Laundered Fabrics and Apparel Textiles

Textile manufacturers routinely subject fabrics to multiple wash and dry cycles to evaluate colorfastness, finish durability, and appearance retention under real-world use. The Agera L2 provides precise, repeatable color and gloss measurement throughout laundering tests, enabling objective assessment of ΔE, ΔL, Δa*, Δb* changes while correlating results with visual perception. Its integrated imaging and gloss measurement capabilities document both chromatic and physical changes, ensuring that every test captures the full appearance profile of the fabric.

Key Benefits

1. Laundered Fabrics and Apparel Textiles

- Pre- vs. Post-Launder Evaluation: Quantifies ΔE, ΔL, Δa*, and Δb* after single or multiple wash cycles following ISO 105 C06 / AATCC 61 methodologies.
- Finish and Dye Stability: Detects brightness or hue shifts caused by residual chemicals, fabric softeners, or mechanical abrasion.
- Batch and Roll Quality Control: Ensures consistent appearance across production runs, linking laundering results to reference standards for approval or release.
- Texture and Surface Degradation: Integrated imaging identifies pilling, fibrillation, and abrasion that alter perceived color or finish quality.
- Optical Brightener Tracking: Differentiates fading of optical brighteners (OBAs) and fluorescent agents, confirming stability under repeated washing.
- Data Documentation and Compliance: EasyMatch Essentials software supports trend analysis, test recordkeeping, and tolerance reporting for ISO and AATCC compliance.

Summary

1. Laundered Fabrics and Apparel Textiles

By combining optical precision, imaging verification, and UV flexibility, the Agera L2 allows textile and apparel manufacturers to quantify colorfastness, maintain finish standards, and document performance durability—ensuring every garment retains its intended appearance and brand quality through repeated use.

Key Application

2. UV and Sun-Exposure Degradation

Outdoor textiles, upholstery fabrics, and performance garments face constant exposure to UV light, heat, and environmental weathering, which can lead to fading, bleaching, and dye photodegradation. The Agera L2 provides a quantitative method for evaluating UV-induced color change, enabling manufacturers to measure brightness drift, compare UV-resistant finishes, and validate protective coatings or stabilizers. Its UV-included and UV-excluded illumination modes allow users to isolate optical brightener effects and differentiate between true color loss and fluorescence change.

Key Benefits

2. UV and Sun-Exposure Degradation

- **Brightness and Hue Drift Measurement**: Quantifies ΔE, ΔL, Δa*, Δb* shifts following UV exposure, revealing early signs of fading or yellowing.
- **UV Sensitivity Evaluation**: Distinguishes color changes in brightener-treated or UV-reactive fabrics using UV-excluded vs. UV-included modes.
- **Finish and Coating Validation**: Confirms the performance of UV-stable finishes, coatings, and fibers through measurable shade retention over time.
- **Visual and Instrumental Correlation**: Supplements Blue Wool scale ratings with instrumental data for accurate, reproducible fade assessment.
- **Accelerated Weathering Studies**: Tracks color degradation trends after simulated sunlight or outdoor exposure to validate material durability.
- **Data Consistency and Reporting**: EasyMatch Essentials software supports trend analysis, standard correlation, and digital documentation for long-term performance verification.

Summary

2. UV and Sun-Exposure Degradation

With its UV control precision, spectral accuracy, and visual correlation, the Agera L2 provides textile, upholstery, and performance fabric manufacturers with a scientific foundation for fade resistance testing—ensuring long-term product reliability, color stability, and aesthetic integrity under real-world sunlight exposure.

Key Application

3. Supplier to Brand Layer Alignment

In global textile and apparel supply chains, color consistency and durability validation are essential for maintaining brand reputation and customer trust. Variations in laundering methods, UV exposure, and visual appearance criteria can cause discrepancies between supplier output and brand standards. The Agera L2 bridges this gap by providing objective, traceable color and gloss data that align visual expectations with measurable performance, ensuring every layer of the supply chain speaks the same color language.

Key Benefits

3. Supplier to Brand Layer Alignment

- **Standardized Color Tolerances**: Establishes numerical CIELAB and ΔE thresholds across pre-wash, post-wash, and after-wear conditions to unify global production.
- **Visual-to-Instrument Correlation**: The 0°/45° circumferential geometry ensures human-eye-correlated data for consistent visual evaluation across facilities.
- **Durability and Longevity Validation**: Provides repeatable, traceable color data to support performance claims related to wear, wash, and UV exposure.
- **Supplier-to-Brand Traceability**: Enables centralized data comparison and certification between contract mills, dye houses, and brand QA teams.
- **Quality Agreement Compliance**: Supports ISO 105 / AATCC 61 protocols for laundering, colorfastness, and material verification testing.
- **Digital Alignment Tools**: Integrated EasyMatch Essentials software facilitates remote data exchange, tolerance tracking, and long-term trend analysis across global networks.

Summary

3. Supplier to Brand Layer Alignment

By creating a common measurement framework, the Agera L2 eliminates subjective color evaluation and regional variation–empowering brands and suppliers worldwide to maintain uniform quality, verified performance, and consistent visual identity from production floor to retail shelf.

HunterLab

Industry Standards & Methods

- ISO 105 C06: Textile – Color Fastness to Domestic and Commercial Laundering.
- AATCC 61: Colorfastness to Laundering – Home and Commercial.
- ISO 105 B02 / AATCC 16: Color Fastness to Light Xenon Arc) and UV exposure.
- CIELAB – color space and ΔE metrics for quantifying color change.

HunterLab Advantage

- **0°/45° circumferential geometry**: Matches how humans view dyed fabrics, capturing accurate color despite surface texture, slubs, knit structure or weave direction.
- **Automated UV-included/excluded modes**: Allows detection of optical brightener changes, UV fading effects and dye photodegradation without needing a separate instrument.
- **Large 51 mm 2-inch port plate**: Averages across multiple yarns, slubs, fabric irregularities or rope bundles, improving repeatability in textured textile samples.
- **Integrated gloss measurement and imaging**: Gives insight into surface changes (e.g., pilling, polish, coating loss) that accompany laundering or UV weathering and affect visual appearance.
- **Embedded EasyMatch Essentials software**: Simplifies the set-up of pre- and post-test comparison methods, trend tracking, and tolerance limits for ΔE or brightness shift, supporting roll-to-roll or batch-to-batch control.
- **Ethernet/USB connectivity**: Enables streamlined export to LIMS/SPC systems where change-over or fade performance must be documented and trended.

Summary

The Agera L2 bridges laboratory accuracy and production-floor practicality. It transforms color and gloss control into a connected, compliant, and visually aligned process across plastics, coatings, pharmaceuticals, textiles, paper, chemicals, and building materials.

With its combination of precision optics, UV control, gloss integration, imaging, and open connectivity, Agera L2 stands as HunterLab’s most versatile spectrophotometer – built for the modern era of digital quality management and Industry 4.0 integration.

9. Textiles

Introducing Agera L2 Next-Generation Color and Appearance Measurement for Textiles, Fibers & Fabrics Color & Appearance Control

Focus: Natural & Synthetic Fibers, UV Measurement and Texture

Color in textiles is influenced by fiber type, surface texture, and fluorescence from brighteners or finishes. The Agera L2's 0°/45° circumferential geometry and automated UV control make it the ideal solution for measuring woven fabrics, knits, and yarns—natural or synthetic—under conditions that match visual perception.

Key Application

1. Dyed and Finished Fabrics

Color quality in dyed and finished fabrics defines visual appeal, customer satisfaction, and brand reliability. The Agera L2 delivers high-precision, human-eye-correlated color measurement across all stages of textile processing–from dyeing and finishing to final inspection. Its 0° illumination / 45° circumferential geometry ensures consistent readings across varied textures, weaves, and finishes, while UV-controlled illumination enables accurate evaluation of optical brighteners, colorfastness, and surface treatments.

Key Benefits

1. Dyed and Finished Fabrics

- **Shade Uniformity Verification**: Measures lot-to-lot and roll-to-roll consistency under UV-included and UV-excluded illumination, ensuring uniform dye application.
- **Finishing Process Evaluation**: Detects subtle color shifts caused by resins, coatings, or heat-setting, verifying that post-treatment processes preserve original shade targets.
- **Colorfastness Monitoring**: Quantifies ΔE changes after washing, abrasion, or UV exposure to validate durability and compliance with performance standards.
- **Optical Brightener Control**: Differentiates between natural whiteness and fluorescent enhancement, allowing precise control of OBAs and FWA concentration.
- **Surface Texture Averaging**: Circumferential geometry compensates for directional scatter in woven, knitted, or brushed fabrics, producing stable, visually correlated data.
- **Data Integration and Traceability**: EasyMatch Essentials software provides automated tolerance management, color trending, and ISO 9001 digital recordkeeping.

Summary

1. Dyed and Finished Fabrics

By combining optical precision, UV flexibility, and data-driven traceability, the Agera L2 empowers textile manufacturers to maintain consistent color, finish integrity, and product appearance from fiber extrusion through final inspection—ensuring every roll meets the highest global quality and aesthetic standards.

Key Application

2. Synthetic Fibers and Texturization

In synthetic fiber manufacturing, color accuracy and texture uniformity are essential for maintaining quality across spinning, drawing, and texturizing operations. The Agera L2 delivers unmatched precision for evaluating polyester, nylon, acrylic, and blended filaments, where surface texture, gloss, and directional light scatter can distort results with conventional instruments. Its 0° illumination / 45° circumferential geometry captures how light interacts with fine filaments and textured yarns, providing stable, human-eye-correlated data for color matching, process validation, and supplier alignment.

Key Benefits

2. Synthetic Fibers and Texturization

- **Texture-Compensated Measurement**: Averages directional scatter from filament bundles and matte finishes, eliminating hue shifts caused by fiber alignment or twist.
- **True Visual Correlation**: Replicates the human-eye response to ensure accurate appearance control for spun, drawn, or texturized fibers.
- **UV-Controlled Brightness Evaluation**: Quantifies optical brighteners (OBAs) and fluorescent whitening agents (FWAs) used to enhance polyester and nylon brightness.
- **Colorfastness and Fade Analysis**: Tracks ΔE, YI, and spectral trends to assess UV degradation, washing, or heat-setting effects on fiber color stability.
- **Surface Gloss and Finish Consistency**: Integrated gloss measurement correlates luster level with polymer draw ratio and finish application.
- **Process Integration and Traceability**: EasyMatch Essentials software enables tolerance setting, lot trending, and digital data archiving for QA systems.

Summary

2. Synthetic Fibers and Texturization

By combining optical precision, UV control, and textural averaging, the Agera L2 empowers fiber producers to maintain shade consistency, brightness uniformity, and visual harmony throughout extrusion, drawing, and finishing–ensuring every filament meets design intent and global quality standards.

Key Application

3. Natural Fibers and Blends

In textile production using cotton, wool, linen, and blended fabrics, natural variability in weave, texture, and surface nap can make consistent color measurement challenging. The Agera L2 overcomes these limitations by providing highly accurate, repeatable color data that reflects true overall appearance. Its large-area measurement port averages irregularities across fibers, ensuring reliable readings that correlate precisely with human visual perception.

HunterLab

Key Benefits

3. Natural Fibers and Blends

- Texture Averaging Geometry: The large-area port minimizes the impact of weave variation, surface nap, and shading, producing stable, representative results.
- Objective Whiteness Evaluation: Provides ΔE, L*, a*, b*, and YI data for quantitative analysis of fiber cleanliness, bleaching efficiency, and whiteness per ASTM E313.
- Shade and Batch Consistency: Enables precise lot-to-lot and supplier comparisons, ensuring consistent appearance across blended and finished goods.
- Finishing Appearance Control: Integrated 60° gloss and imaging functions evaluate luster, surface sheen, and finishing uniformity.
- UV-Controlled Illumination: Accurately measures the effects of optical brighteners (OBAs) and fluorescent whitening agents (FWAs) used in textile finishing.
- Data Management and Compliance: EasyMatch Essentials software supports trend tracking, tolerance control, and data archiving to meet ISO and production documentation requirements.

Summary

3. Natural Fibers and Blends

With its combination of broad optical averaging, UV versatility, and software integration, the Agera L2 enables manufacturers to achieve consistent whiteness, balanced texture appearance, and reliable color uniformity across all stages of natural fiber processing–from scouring and bleaching to finishing and final inspection.

Key Application

4. Appearance Analysis for Finishing

The Agera L2 provides complete appearance analysis for textile finishing, combining integrated gloss measurement and high-resolution imaging to quantify visual attributes that extend beyond color alone. In modern textile production, controlling surface sheen, texture, and uniformity is essential for maintaining product identity and ensuring batch-to-batch consistency across fabrics with varying finishes—from high-luster satins to matte technical textiles.

The Agera L2 bridges visual and instrumental assessment, allowing manufacturers to standardize appearance parameters that once relied solely on subjective evaluation.

Key Benefits

4. Appearance Analysis for Finishing

- **Integrated Gloss Measurement:** Built-in 60° gloss sensor quantifies surface reflectance and sheen differences across satin, silk, or coated fabrics.
- **Imaging-Based Texture Evaluation:** High-resolution imaging captures mottling, pattern variation, and surface irregularities, providing visual confirmation of finish uniformity.
- **Comprehensive Appearance Data:** Simultaneous color, gloss, and image capture ensures full correlation between tone and surface effects.
- **Process Optimization:** Enables objective feedback for finishing processes such as calendaring, coating, or embossing.
- **Quality Traceability:** EasyMatch Essentials software records appearance metrics for each lot, ensuring reproducibility and documentation compliance.

Summary

4. Appearance Analysis for Finishing

By combining quantitative gloss data and visual imaging verification, the Agera L2 gives textile manufacturers a powerful tool to monitor, control, and certify the complete appearance quality of finished fabrics–transforming subjective visual judgments into consistent, measurable, and traceable results.

HunterLab

Industry Standards & Methods

- AATCC 173 – Reflectance Measurements for Textiles.
- ISO 105 B02/B04 – Colorfastness to Light and Washing.
- ASTM E1164/E1349 – Color Measurement of Textiles and Fabrics.
- CIELAB – Visual Correlation of Textile Color.

HunterLab Advantage

- **UV control**: for optical brightener quantification.
- **0°/45° circumferential optics**: for texture averaging.
- **Large port and imaging**: for woven and non-woven uniformity.
- **Simultaneous color and gloss measurement**: for appearance mapping.
- **Seamless Integration with LIMS & SPC Systems**: Plug-and-play connection via Ethernet or USB – no proprietary drivers, automatic data export to LIMS, SPC, or MES systems, real-time color trending and remote diagnostics, and secure, traceable communication compliant with GMP and ISO 17025 workflows.
- **Embedded EasyMatch Essentials Software**: Complete On-Board Control. provides full measurement and reporting capability right from the touchscreen.
- **PC & External Display Connectivity**: Connect via USB to a PC for expanded analysis, long-term storage, or multi-instrument networking. Link to an external display for group training or collaborative QA review.
- **Simplified operation**: Reduces training time and ensures consistent user performance.

Summary

The Agera L2 delivers textile color accuracy equal to human vision—enhanced by UV management for fluorescent and brightened materials. Whether measuring fiber brightness, dyed fabric consistency, or finish gloss, it provides a complete, repeatable appearance profile for every textile product.

Agera L2 | Case Studies

HunterLab

Note on Case Studies

The following case studies presented are hypothetical in form but grounded in real-world experience and industry practice. Each example draws upon decades of HunterLab's work with global manufacturers, laboratories, and quality teams across plastics, coatings, chemicals, pharmaceuticals, and building materials.

While company names and scenarios are generalized for confidentiality, the challenges, measurement methods, and solutions reflect authentic field data, proven applications, and validated instrument performance.

These examples are designed to illustrate how HunterLab technologies, such as the Agera L2, are practically implemented to solve common appearance-control problems and deliver measurable quality and efficiency improvements.

1. Bio-Pharmaceuticals

1. Enhancing Powdered Drug Product Quality through Instrumental Color Measurement
2. Controlling Color and Appearance in Tablets, Pills, Capsules, and Caplets
3. Managing Gloss and Coating Uniformity in Appearance-Critical Pharmaceutical Components

Case Study 1 – Monitoring Stability and Blend Uniformity in Powdered Drug Products

A major pharmaceutical manufacturer producing APIs and powdered blends for solid dosage forms sought to improve color-based stability and homogeneity monitoring throughout formulation and drying processes. Subtle discoloration often indicated oxidation, incomplete drying, or contamination.

HunterLab

Case Study 1 – Monitoring Stability and Blend Uniformity in Powdered Drug Products

Customer Challenge:

Manual color evaluation could not reliably detect small hue or brightness changes indicating process drift.

Challenges included:

- Gradual yellowing of active ingredients during drying or storage.
- Inconsistent blending leading to visible streaking in final tablet compression.
- Inability to link color data with process parameters or stability results.
- Time-intensive visual inspections lacking documentation for regulatory compliance.

Case Study 1 – Monitoring Stability and Blend Uniformity in Powdered Drug Products

Solution Implementation:

The Agera L2 was integrated into the company's analytical laboratory workflow.

Using the large-area port, powders were measured directly without pressing or dilution, preserving true reflectance characteristics.

CIELAB and YI data were recorded before and after blending, drying, and storage to monitor ΔE changes.

The UV-included/excluded modes isolated discoloration caused by photo-reactive impurities.

Color trending within EasyMatch Essentials was linked to the plant's batch record system for regulatory documentation and process control.

HunterLab

Case Study 1 – Monitoring Stability and Blend Uniformity in Powdered Drug Products

Benefits / Outcomes:

- **Real-Time Stability Monitoring:** Identified oxidation before visual discoloration appeared.
- **Blend Uniformity Verification:** Reduced blend failure risk by quantifying homogeneity during processing.
- **Improved Regulatory Documentation:** Objective, traceable color data satisfied cGMP and 21 CFR Part 11 requirements.
- **Non-Destructive Testing:** Direct measurement eliminated sample prep variability.
- **Enhanced Quality Assurance:** 20% reduction in batch reprocessing due to early anomaly detection.

By implementing the Agera L2, the pharmaceutical manufacturer achieved precise, traceable color measurement throughout powder processing–improving consistency, compliance, and process confidence.

Case Study 2 – Verifying Coating Appearance in High-Gloss Pharmaceutical Components

A specialty pharmaceutical manufacturer producing film-coated tablets and capsule shells for leading OTC brands required a reliable system to measure color, gloss, and surface uniformity. Brand differentiation depended on consistent luster and finish, even under varied lighting.

HunterLab

Case Study 2 – Verifying Coating Appearance in High-Gloss Pharmaceutical Components

Customer Challenge:

Visual inspection identified inconsistent gloss and mottling in coated products but lacked quantifiable correlation.

The primary issues included:

- Micro-variations in spray coating thickness causing shade imbalance.
- Uneven gloss that changed perceived hue.
- Inconsistent inspection results between shifts.
- No imaging records to verify visual defects.

HunterLab

Case Study 2 – Verifying Coating Appearance in High-Gloss Pharmaceutical Components

Solution Implementation:

The Agera L2 provided simultaneous color and gloss measurement under controlled illumination.

Imaging captured each measurement area, documenting coating defects and confirming sample uniformity.

CIELAB and gloss data were linked within EasyMatch Essentials to identify trends across coating batches and spray gun settings.

Results were shared across quality and production teams to optimize parameters.

HunterLab

Case Study 2 – Verifying Coating Appearance in High-Gloss Pharmaceutical Components

Benefits / Outcomes:

- **Objective Defect Detection**: Imaging identified mottling and uneven spray not visible to the eye.
- **Integrated Appearance Analysis**: Combined gloss and color data improved coating control.
- **Reduced Product Rework**: Early detection lowered appearance-related rejections by 25%.
- **Improved Interdepartmental Coordination**: Shared data linked production and QA metrics.
- **Enhanced Brand Consistency**: Reliable, repeatable finish quality reinforced customer confidence.

By integrating the Agera L2 into daily QA and process feedback loops, the manufacturer established a quantifiable, traceable standard for high-gloss coated pharmaceutical components–elevating product uniformity and visual quality assurance.

Case Study 3 – Standardizing Coating and Color in Tablets, Capsules, and Caplets

A contract pharmaceutical producer manufacturing solid dosage products for multiple clients needed to ensure appearance consistency and coating uniformity across tablets, capsules, and caplets. Brand owners demanded strict adherence to target shade, gloss, and surface smoothness.

Case Study 3 – Standardizing Coating and Color in Tablets, Capsules, and Caplets

Customer Challenge:

Variations in coating viscosity, drying rate, and polishing caused visible appearance differences between lots.

Issues included:

- Inconsistent color across different coating pans and shifts.
- Surface gloss differences misinterpreted as hue variation.
- High rejection rates for aesthetic defects despite acceptable chemical analysis.
- Lack of repeatable alignment of small, curved samples during measurement.

HunterLab

Case Study 3 – Standardizing Coating and Color in Tablets, Capsules, and Caplets

Solution Implementation:

The manufacturer deployed the Agera L2 with custom pill, tablet, and capsule holders for consistent sample positioning.

The 0° illumination / 45° circumferential geometry ensured visual correlation, while the integrated gloss sensor differentiated true color variation from sheen changes.

ΔE2000 tolerances were defined in EasyMatch Essentials, and automatic batch trending confirmed coating process stability.

Data was archived under secure, 21 CFR Part 11–compliant digital records for audit readiness.

HunterLab

Case Study 3 – Standardizing Coating and Color in Tablets, Capsules, and Caplets

Benefits / Outcomes:

- **Improved Coating Uniformity**: Coating color deviation reduced by 40%.
- **Enhanced Visual Consistency**: Gloss-related color confusion eliminated.
- Repeatable Sample Alignment: Custom holders ensured reproducibility within ±0.02 ΔE.
- **Faster Batch Release**: Automated pass/fail review shortened approval time by 25%.
- **Regulatory Compliance**: Digitally stored results met audit and traceability requirements.

The Agera L2 transformed tablet and capsule appearance evaluation into a quantitative, automated process—aligning color, gloss, and quality data for globally consistent results

HunterLab

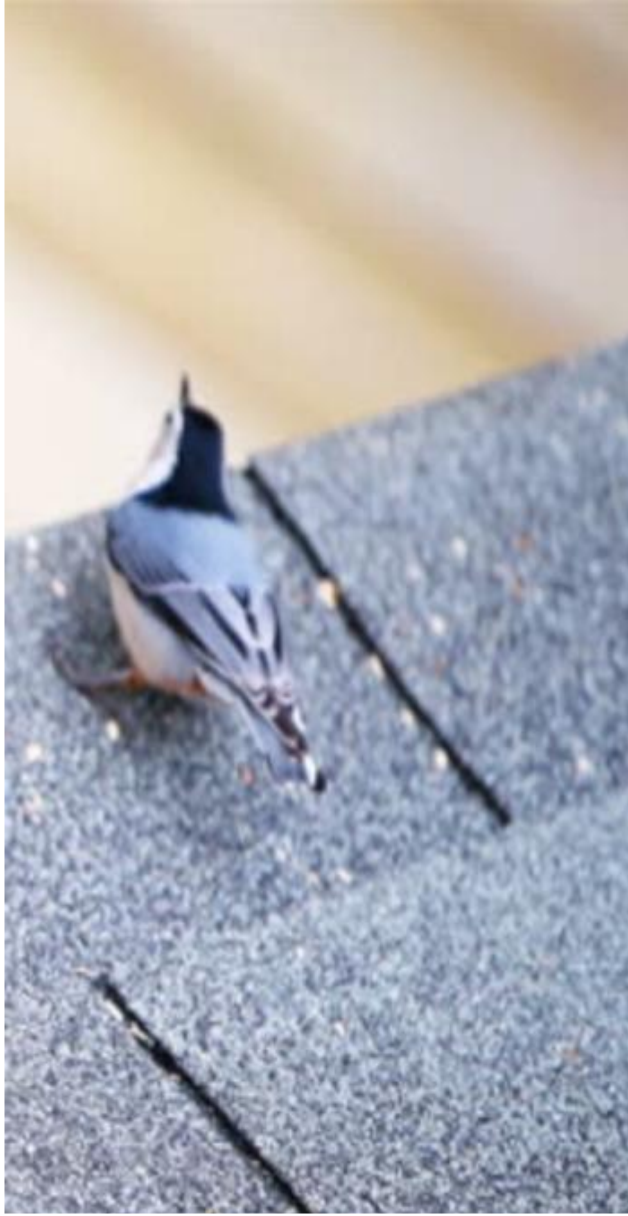
2. Building Materials

1. Managing Appearance Consistency Between Wet and Dry Cement States
2. Ensuring Color and Reflectance Uniformity in Roofing Granules and Shingles
3. Achieving Coating and Gloss Uniformity in Architectural Metal Panels
4. Verifying Color and Texture Consistency in Precast Concrete Panels

HunterLab

Case Study 2 – Ensuring Color and Reflectance Uniformity in Roofing Granules and Shingles

A major roofing materials manufacturer producing asphalt shingles and ceramic-coated granules sought to maintain consistent color, brightness, and reflectance in weather-resistant coatings. Visual differences in roof color across production lots led to consumer complaints and rework.



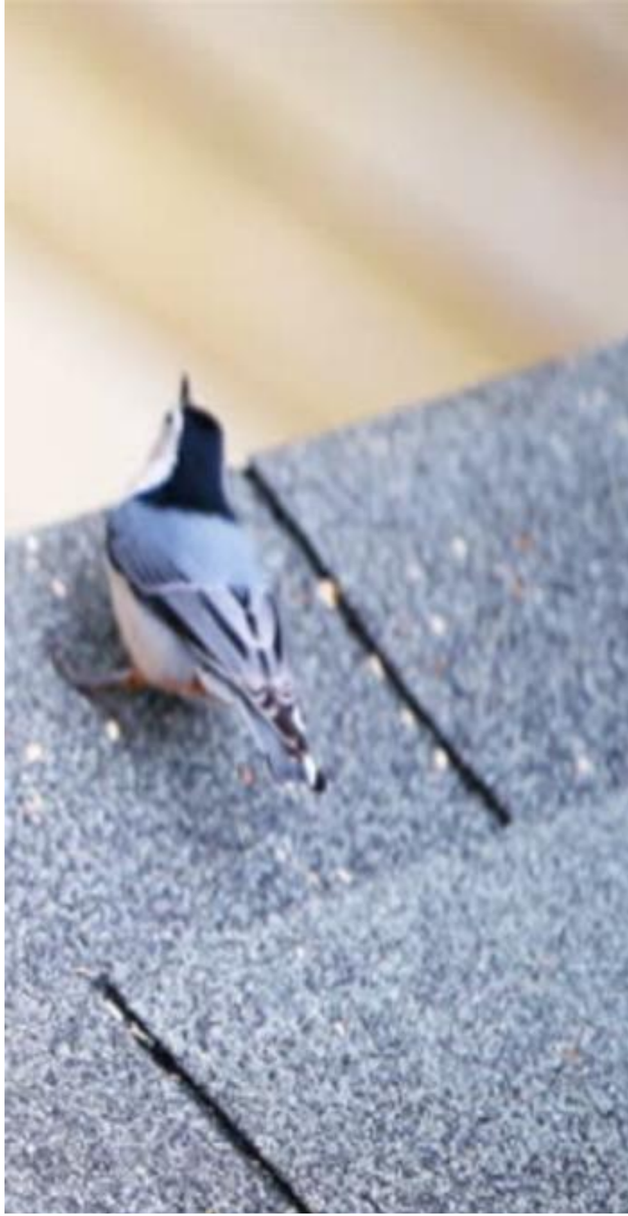
Case Study 2 – Ensuring Color and Reflectance Uniformity in Roofing Granules and Shingles

Customer Challenge:

Granules are highly irregular, angular materials that scatter light unpredictably, complicating traditional color measurement.

The company faced challenges including:

- Non-uniform readings due to texture and particle size variation.
- Fade and brightness loss from UV and environmental exposure.
- Uneven coating loads causing gloss and tone inconsistencies
- Lack of a reliable method for evaluating solar-reflective pigments.



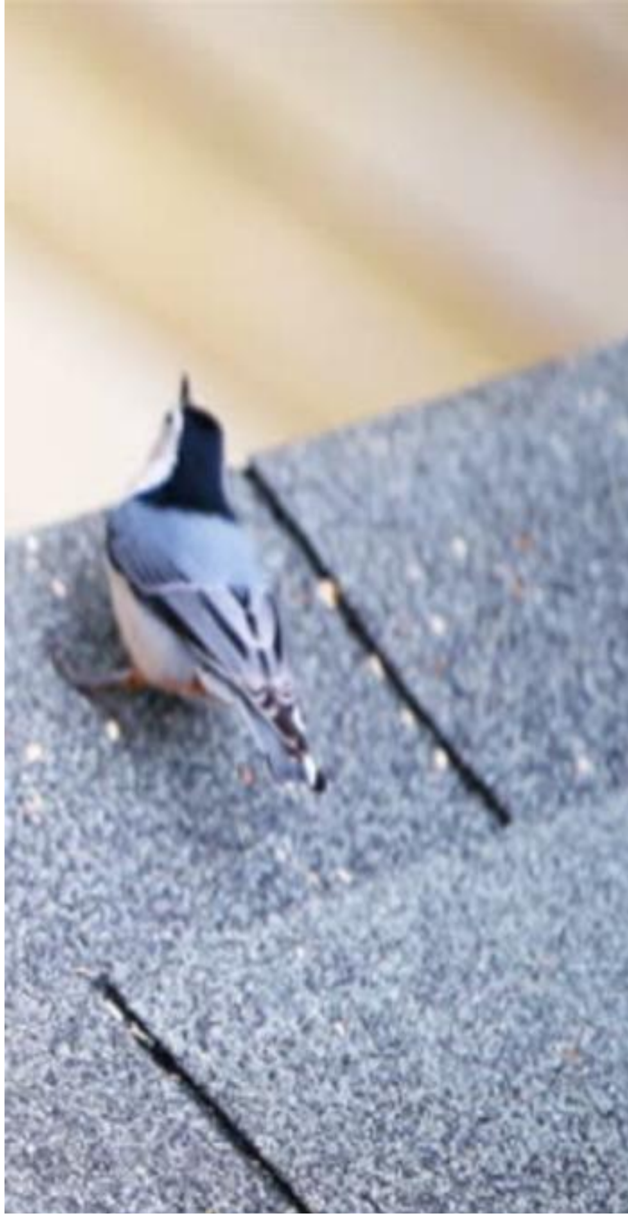
Case Study 2 – Ensuring Color and Reflectance Uniformity in Roofing Granules and Shingles

Solution Implementation:

The Agera L2 was configured with the 51 mm measurement port to average across multiple granules, providing representative color data.

Its 0°/45° circumferential geometry captured light scatter accurately, while UV-included/excluded modes isolated reflectance effects from "cool roof" pigments.

ΔE and YI data were trended in EasyMatch Essentials for lot release, and samples were periodically re-tested post-UV exposure to monitor fading.

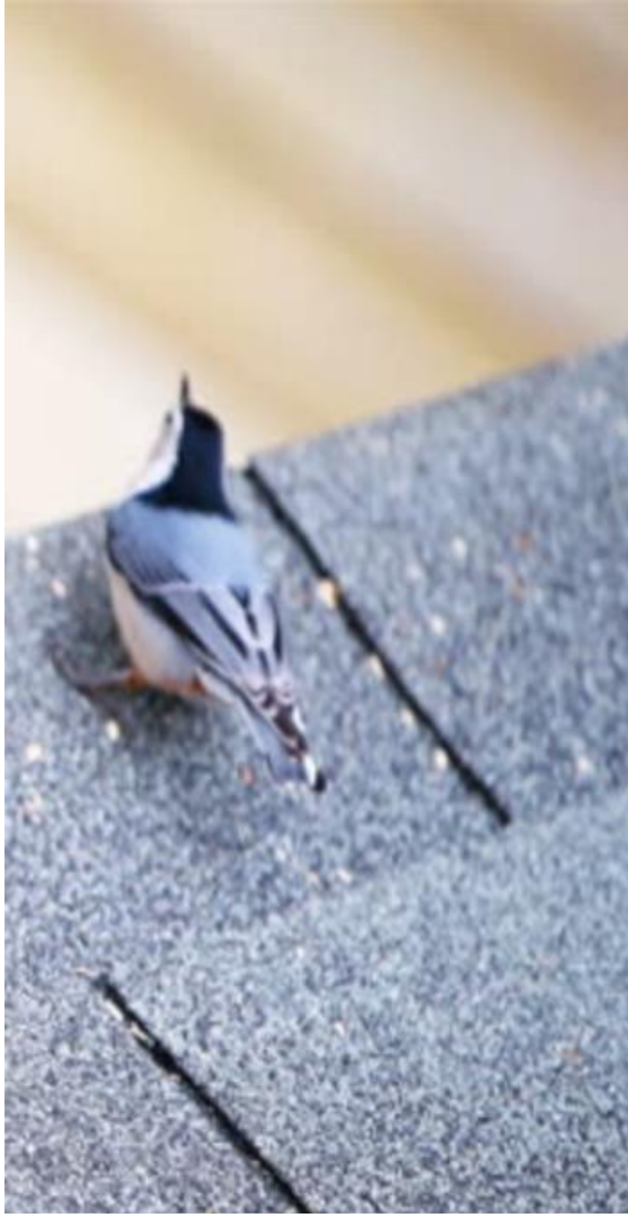


Case Study 2 – Ensuring Color and Reflectance Uniformity in Roofing Granules and Shingles

Benefits / Outcomes:

- **True Texture Averaging**: Large-area port ensured stable, representative measurements on irregular surfaces.
- **UV Fade Tracking**: Quantified color stability after accelerated weathering and sunlight exposure.
- **Improved Process Control**: Detected hue drift linked to coating load and cure variation.
- **Objective Quality Certification**: Provided data-driven lot release and warranty documentation.
- **Enhanced Market Differentiation**: Verified solar reflectance improved "cool roof" product performance claims.

Through the Agera L2, the roofing manufacturer gained a reliable, repeatable method for evaluating coated granules—ensuring consistent, fade-resistant roof color and performance across product



Case Study 1 – Managing Appearance Consistency Between Wet and Dry Cement States

A leading cement manufacturer producing bulk, bagged, and pre-cast mixes sought to improve color consistency and appearance predictability between wet and dry material states. Cement color variation—especially during hydration and curing—often caused aesthetic and quality disputes among construction clients and architects.

Case Study 1 – Managing Appearance Consistency Between Wet and Dry Cement States

Customer Challenge:

Cement exhibits dynamic color behavior: it appears darker and glossier when wet, then lightens significantly as it cures. Traditional colorimeters struggled to correlate readings between these states, resulting in unreliable QC data.

Common challenges included:

- Inability to quantify color change during hydration and curing.
- Subjective visual comparison between wet and dry samples.
- High variability in readings due to texture, porosity, and surface moisture.
- Lack of correlation between laboratory results and real-world field appearance.

The manufacturer needed an instrument that could accurately measure both wet and dry cement surfaces and correlate the data to perceived color under varying environmental conditions.

Case Study 1 – Managing Appearance Consistency Between Wet and Dry Cement States

Solution Implementation:

The company implemented the Agera L2, using its large 51 mm port and 0°/45° circumferential geometry to average reflectance across rough, porous cement surfaces.

Wet and dry samples were measured at set intervals to establish color transition profiles during hydration and curing.

UV-included/excluded illumination modes helped identify brightener or mineral additive effects.

Data was logged in EasyMatch Essentials, enabling operators to generate ΔE and YI curves showing predictable color evolution from mix to cured product.

Case Study 1 – Managing Appearance Consistency Between Wet and Dry Cement States

Benefits / Outcomes:

- **Quantified Wet-to-Dry Transition**: Established numerical benchmarks for appearance changes over curing time.
- **Texture-Independent Accuracy**: Circumferential geometry minimized variability from surface roughness.
- **Improved Process Validation**: Linked appearance change to moisture content and curing chemistry.
- **Architectural Confidence**: Provided predictable finish specifications for end users.
- **Reduced Disputes**: Objective data replaced subjective field evaluation in color claims.

By adopting the Agera L2, the cement producer achieved measurable control over appearance during curing–ensuring predictable, consistent visual outcomes from laboratory to jobsite.

Case Study 3 – Achieving Coating and Gloss Uniformity in Architectural Metal Panels

A large metal façade and building systems manufacturer producing pre-coated aluminum and steel panels needed to ensure appearance consistency across high-profile architectural projects. Even slight shade or gloss variation between panel lots could compromise the visual integrity of building exteriors.

Case Study 3 – Achieving Coating and Gloss Uniformity in Architectural Metal Panels

Customer Challenge:

Panels were coated at multiple plants under different conditions, leading to subtle but noticeable appearance variation in installed façades.

Challenges included:

- Inconsistent color and gloss between coating batches.
- Micro-texture and flow variations affecting perceived shade.
- Difficulty verifying compliance with ASTM D2244 (color) and D523 (gloss) standards.
- Visual mismatches between coil and post-fabrication finishes.

Case Study 3 – Achieving Coating and Gloss Uniformity in Architectural Metal Panels

Solution Implementation:

The Agera L2 was introduced as the reference instrument across all coating and fabrication facilities.

Its 0°/45° circumferential geometry eliminated specular reflection bias, while the integrated 60° gloss sensor provided complete appearance correlation.

ΔE2000 and gloss tolerances were managed via EasyMatch Essentials, and coating data was linked to customer certification reports.

Imaging functionality documented surface defects such as orange peel or flow anomalies for root-cause analysis.

Case Study 3 – Achieving Coating and Gloss Uniformity in Architectural Metal Panels

Benefits / Outcomes:

- **Unified Appearance Control**: Single measurement captured color and gloss simultaneously.
- **Cross-Facility Standardization**: Inter-instrument $\Delta E \leq 0.10$ maintained across plants.
- **Improved Defect Detection**: Imaging identified subtle texture defects invisible to visual inspection.
- **Regulatory Alignment**: Automated ASTM-compliant reporting for project specifications.
- **Enhanced Aesthetic Integrity**: Consistent façade appearance strengthened brand reputation.

The Agera L2 established a single, objective color and gloss verification standard—ensuring every metal panel delivered to site met both visual and technical quality criteria.

Case Study 4 – Verifying Color and Texture Consistency in Precast Concrete Panels

A regional precast concrete manufacturer producing architectural panels and decorative elements required improved methods for color uniformity, pigment consistency, and surface finish validation. Architects demanded color-matched panels for large façade projects, yet natural variability in aggregate and curing caused visible differences.

HunterLab

Case Study 4 – Verifying Color and Texture Consistency in Precast Concrete Panels

Customer Challenge:

Manual color inspection under ambient light produced inconsistent evaluations.

Problems included:

- Color and tone variation between batches or pours.
- Surface texture differences from form type and curing conditions.
- Unquantified effects of sealers and curing compounds on color appearance.
- Inconsistent documentation for project compliance.

HunterLab

Case Study 4 – Verifying Color and Texture Consistency in Precast Concrete Panels

Solution Implementation:

The Agera L2 provided quantitative measurement of color and gloss using 0°/45° circumferential geometry and a large 51 mm port to average across textured surfaces.

ΔE and YI trends were used to monitor pigment concentration and binder ratios.

Gloss data helped evaluate surface coatings and sealant uniformity.

All results were managed within EasyMatch Essentials, producing digital reports for ISO 9001 and architectural quality submittals.

HunterLab

Case Study 4 – Verifying Color and Texture Consistency in Precast Concrete Panels

Benefits / Outcomes:

- **Consistent Panel Appearance**: ΔE variation reduced by 35% between production lots.
- **Texture-Independent Measurement**: Circumferential geometry minimized surface variation bias.
- **Improved Coating Evaluation**: Quantified gloss changes linked to sealers and curing agents.
- **Objective Documentation**: Digital records supported project acceptance and warranty validation.
- **Architectural Confidence**: Reliable, repeatable data ensured visual uniformity in finished installations.

With the Agera L2, the precast manufacturer established a new benchmark for appearance quality—providing architects and contractors with scientifically verified consistency across every project.

3. Chemicals and Minerals

1. Establishing Objective Whiteness and Grade Classification for Mineral Powders and Aggregates
2. Monitoring Oxidation and Moisture Effects in Chemical Intermediates and Catalysts
3. Maintaining Coating and Color Uniformity in Dry Fertilizer Production
4. Quantifying Whiteness and Optical Brightener Response in Powdered Detergents
5. Monitoring Color Stability in Opaque and Translucent Liquid Detergents
6. Ensuring Visual Uniformity and Stability in Detergent Pods
7. Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings

Case Study 7 – Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings

A global architectural coatings manufacturer producing interior and exterior paints, primers, and specialty finishes sought to improve color accuracy and consistency in deep black and charcoal coatings. These products are widely used in premium wall paints, metal finishes, and exterior façade applications where aesthetic depth, uniform coverage, and batch-to-batch consistency define brand quality.2.

Case Study 7 – Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings

Customer Challenge:

Black and near-black paints are among the most difficult to measure accurately. Traditional 45°/0° and sphere-based spectrophotometers often produce unstable readings below 20 % reflectance, especially on samples with variable gloss or micro-texture.
Common problems included:

- Detector noise and stray light interference causing poor repeatability in dark regions.
- Inability to differentiate subtle undertones in carbon black, iron oxide, and mixed pigment systems.
- Discrepancies between gloss levels (flat, eggshell, semi-gloss) leading to mismatched visual appearance despite similar numerical values.

The manufacturer needed an instrument capable of capturing true visual color correlation on ultra-low-reflectance coatings, from matte architectural finishes to high-sheen decorative paints.

Case Study 7 – Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings

Solution Implementation:

The customer implemented the Agera L2, leveraging its 0° illumination / 45° circumferential viewing geometry to emulate human-eye perception while minimizing glare.

Its high-dynamic-range detector and advanced LED illumination system provided superior sensitivity across the dark end of the visible spectrum, accurately resolving color differences in samples with less than 20 % reflectance.

The integrated 60° gloss sensor allowed the QC team to correlate gloss and color changes within a single measurement, eliminating the need for separate instruments.

Using EasyMatch Essentials, operators established digital color standards, ΔE2000 tolerances, and real-time data transfer to the company's LIMS, ensuring traceability and uniformity across global production sites.

Case Study 7 – Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings

Benefits / Outcomes:

- **Improved Accuracy on Dark Coatings**: Stable, repeatable ΔE ≤ 0.02 performance on black and charcoal samples below 20 % reflectance.
- **Complete Appearance Measurement**: Simultaneous color + gloss data accurately represents perceived depth and finish.
- **Visual Correlation Across Sheens**: Circumferential geometry eliminates gloss bias, harmonizing matte to semi-gloss formulations.
- **Enhanced Quality Control Efficiency**: Faster approval cycles and fewer retests reduce production downtime.
- **Global Standardization**: Inter-instrument agreement ≤ 0.10 ΔE ensures consistent appearance across regional plants.

By integrating the Agera L2, the manufacturer established a new color-control standard for architectural coatings, delivering reliable performance and visual consistency even in the darkest pigment systems.

Case Study 1 – Establishing Objective Whiteness and Grade Classification for Mineral Powders and Aggregates

A global industrial minerals processor supplying limestone, kaolin, and bauxite for use in coatings, ceramics, and construction materials sought to standardize whiteness grading and product classification across production sites. Product brightness and color consistency directly impacted customer acceptance and pricing tiers.

Case Study 1 – Establishing Objective Whiteness and Grade Classification for Mineral Powders and Aggregates

Customer Challenge:

The company relied on subjective visual grading methods that varied by operator and environment. Differences in particle size, moisture content, and sample compaction introduced significant measurement error.

Key challenges included:

- Inconsistent brightness grading across production shifts and facilities.
- Operator bias from visual whiteness assessment.
- Difficulty correlating laboratory results to bulk product appearance.
- Lack of quantifiable, traceable data for export quality certification.

HunterLab

Case Study 1 – Establishing Objective Whiteness and Grade Classification for Mineral Powders and Aggregates

Solution Implementation:

The Agera L2 was deployed at central laboratories to establish objective whiteness control per ASTM E313.

Using its large-area flat dish holder, powders and coarse aggregates were measured directly without compression, preserving natural optical scatter.

The 0°/45° circumferential geometry produced visually correlated color data independent of particle orientation, while EasyMatch Essentials software trended ΔE and YI results to track grade variation.

Digital standards were distributed to remote facilities for global harmonization.

Case Study 1 – Establishing Objective Whiteness and Grade Classification for Mineral Powders and Aggregates

Benefits / Outcomes:

- **Objective Whiteness Indexing**: ASTM E313 whiteness values replaced visual judgment.
- **Consistent Product Grading**: Inter-lab ΔE variation reduced from 0.38 to 0.10.
- **Improved Process Control**: Color data correlated directly with milling and calcination parameters.
- **Digital Certification**: Automated quality documentation enhanced customer transparency.
- **Global Alignment**: Unified brightness scale standardized quality across all production sites.

By implementing the Agera L2, the mineral processor replaced subjective grading with a traceable, data-driven framework–ensuring consistent product appearance and reliable material classification worldwide.

Case Study 2 – Monitoring Oxidation and Moisture Effects in Chemical Intermediates and Catalysts

A chemical manufacturer producing intermediates, metal oxides, and catalytic powders for the energy and polymer sectors sought to monitor color shifts caused by oxidation, hydration, or contamination that affected reactivity and yield.

HunterLab

Case Study 2 – Monitoring Oxidation and Moisture Effects in Chemical Intermediates and Catalysts

Customer Challenge:

Subtle color variations often indicated unwanted reactions or instability, yet conventional tools could not detect early-stage discoloration.

The company faced:

- Inability to quantify photo-reactive or moisture-induced color changes.
- Untraceable batch-to-batch variability affecting catalyst performance.
- Subjective inspection insufficient for quality validation.
- No standardized color trending system across plants.

Case Study 2 – Monitoring Oxidation and Moisture Effects in Chemical Intermediates and Catalysts

Solution Implementation:

The Agera L2 was installed for both R&D and production QC monitoring.

Using UV-included/excluded modes, the team measured Yellowness Index (YI) and Δb* changes to identify oxidation or moisture uptake.

The 0°/45° circumferential geometry ensured repeatable readings on powders and granular materials, while the high-dynamic-range optics captured subtle tone shifts even in dark or low-reflectance samples.

All results were tracked within EasyMatch Essentials, integrated with the company's batch record and traceability systems.

Case Study 2 – Monitoring Oxidation and Moisture Effects in Chemical Intermediates and Catalysts

Benefits / Outcomes:

- **Early Instability Detection**: Detected oxidation before measurable catalytic activity loss.
- **Quantified Moisture Uptake**: YI trending linked to drying efficiency metrics.
- Improved Process Consistency: Batch variability reduced by 25%.
- **Enhanced R&D Feedback**: Enabled formulation comparison based on spectral trends.
- **Data Traceability**: Automated reporting ensured ISO 9001 and GMP compliance.

The Agera L2 delivered a quantitative foundation for process optimization and quality assurance—transforming color from a subjective observation into a predictive performance indicator for chemical intermediates.

Case Study 3 – Maintaining Coating and Color Uniformity in Dry Fertilizer Production

A fertilizer manufacturer producing powdered and granular NPK formulations required reliable color measurement to ensure batch uniformity, coating coverage, and brightness consistency. Color variation was often linked to uneven coating load or excess moisture, which affected market perception and product handling.

Case Study 3 – Maintaining Coating and Color Uniformity in Dry Fertilizer Production

Customer Challenge:

The company's visual inspections could not consistently detect subtle hue and brightness differences between lots.

Major challenges included:

- Irregular color distribution due to incomplete coating or drying.
- Moisture absorption causing yellowing or darkening over time.
- Variation in perceived brightness affecting brand recognition.
- Lack of quantitative metrics for process verification.

HunterLab

Case Study 3 – Maintaining Coating and Color Uniformity in Dry Fertilizer Production

Solution Implementation:

The Agera L2 was configured to measure both powdered and granular fertilizers directly using the large-area port.

The 0°/45° circumferential geometry averaged reflectance over irregular surfaces, while UV-controlled illumination identified effects of brighteners or degradation.

CIELAB, ΔE, and YI data were analyzed in EasyMatch Essentials, with tolerance thresholds set for automatic pass/fail decisions during batch release.

HunterLab

Case Study 3 – Maintaining Coating and Color Uniformity in Dry Fertilizer Production

Benefits / Outcomes:

- **Consistent Coating Uniformity**: ΔE variation reduced by 40% between production lots.
- **Moisture Degradation Detection**: Color trending identified drying inefficiencies.
- **Improved Brand Appearance**: Stable brightness maintained across product lines.
- **Reduced Waste**: Objective data prevented unnecessary reprocessing.
- **Regulatory Traceability**: Digital records supported fertilizer quality certification.

By integrating the Agera L2 into its QA process, the manufacturer established a repeatable color verification system–improving consistency, quality assurance, and market confidence in product appearance.

Case Study 4 – Quantifying Whiteness and Optical Brightener Response in Dry Detergents

A large consumer products manufacturer producing opaque and translucent liquid detergents needed to monitor color uniformity, gloss, and stability across various formulations. Color inconsistencies were affecting consumer trust and perceived product quality.

Case Study 4 – Quantifying Whiteness and Optical Brightener Response in Dry Detergents

Customer Challenge:

Liquid detergents presented unique optical challenges due to transparency, viscosity, and surface reflection.

Issues included:

- Shade drift from dye fading or ingredient aging.
- Inconsistent color between opaque and translucent variants.
- Visual mismatch between production batches stored under different lighting or temperature conditions.
- No integrated system for correlating gloss and color perception.

HunterLab

Case Study 4 – Quantifying Whiteness and Optical Brightener Response in Dry Detergents

Solution Implementation:

The Agera L2 measured both color and gloss simultaneously, using 0° illumination / 45° circumferential viewing geometry to replicate visual appearance through curved translucent packaging.

UV-included/excluded modes identified photo-reactive dye degradation, and EasyMatch Essentials tracked ΔE and gloss changes over time.

Batch trend data were linked to formulation adjustments to maintain uniformity across variants.

Case Study 4 – Quantifying Whiteness and Optical Brightener Response in Dry Detergents

Benefits / Outcomes:

- **Comprehensive Appearance Profiling**: Integrated color and gloss measurement in one system.
- **Photo-Degradation Detection**: UV-based readings revealed dye instability early.
- **Consistent Batch-to-Batch Quality**: Visual appearance standardized across all product types.
- **Reduced Customer Complaints**: Improved confidence in visual consistency.
- **Streamlined Quality Release**: Real-time digital pass/fail tolerance checks accelerated batch approval.

The Agera L2 provided the manufacturer with a holistic appearance control platform–ensuring consistent color, gloss, and transparency in every liquid detergent formulation.

Case Study 5 – Monitoring Color Stability in Opaque and Translucent Liquid Detergents

A global producer of powdered laundry detergents sought to improve OBA (optical brightener agent) control and color uniformity in high-brightness formulations. Perceived "clean white" appearance was a key marketing attribute directly tied to optical brightness under UV illumination.

Case Study 5 – Monitoring Color Stability in Opaque and Translucent Liquid Detergents

Customer Challenge:

Fluorescent whitening agents and recycled filler variability caused inconsistent visual brightness between batches.

Primary challenges included:

- Over- or under-dosed OBAs altering whiteness perception.
- Lack of UV-controlled instrumentation for accurate fluorescence measurement.
- Variability introduced by powder texture and moisture content.
- Subjective visual grading not aligned with consumer lighting conditions.

HunterLab

Case Study 5 – Monitoring Color Stability in Opaque and Translucent Liquid Detergents

Solution Implementation:

The Agera L2 was introduced for direct measurement of detergent powders without compaction, maintaining natural optical scatter.

Its UV-included/excluded modes isolated the contribution of optical brighteners to total reflectance.

CIELAB and YI data were trended in EasyMatch Essentials, correlating brightness and hue to additive dosage and production parameters.

Digital tolerances were used to approve or adjust batch formulations before packaging.

Case Study 5 – Monitoring Color Stability in Opaque and Translucent Liquid Detergents

Benefits / Outcomes:

- **Controlled OBA Dosage**: Optimized fluorescence level for consistent brightness perception.
- **Improved Whiteness Stability**: Reduced ΔE variation by 35% across lines.
- **Objective UV Measurement**: True differentiation between natural and fluorescent whiteness.
- **Reduced Overuse of Additives**: Lower optical brightener consumption without visual compromise.
- **Consistent Brand Aesthetics**: Uniform appearance under both daylight and UV light sources.

With the Agera L2, the detergent producer achieved objective, data-driven whiteness control–ensuring predictable brightness, cost efficiency, and consistent shelf presentation worldwide.

.

Case Study 6 – Ensuring Visual Uniformity and Stability in Detergent Pods

A manufacturer of single-dose detergent pods producing multi-phase gel formulations required accurate color and gloss evaluation to ensure visual uniformity and product stability. Color differences between capsule layers were leading to aesthetic inconsistencies and brand perception issues.

Case Study 6 – Ensuring Visual Uniformity and Stability in Detergent Pods

Customer Challenge:

The company faced several quality challenges:

- Color shift between gel phases caused by dye migration.
- Surface gloss variation reducing the visual appeal of pods.
- UV-induced fading of transparent capsule shells.
- Difficulty measuring curved and reflective surfaces consistently.

HunterLab

Case Study 6 – Ensuring Visual Uniformity and Stability in Detergent Pods

Solution Implementation:

The Agera L2 provided simultaneous color and gloss data on pod surfaces using its 0°/45° circumferential geometry, which eliminated glare from curved, translucent shells.

UV-controlled illumination modes were used to detect dye degradation, while ΔE and gloss results were analyzed through

EasyMatch Essentials software for trend tracking.

Pods were measured in rotational fixtures to ensure consistent sample orientation and reproducibility.

HunterLab

Case Study 6 – Ensuring Visual Uniformity and Stability in Detergent Pods

Benefits / Outcomes:

- **Enhanced Product Uniformity**: Color and gloss consistency improved across batches.
- **UV Stability Validation**: Photo-reactive dye fading detected before consumer exposure.
- **Improved Brand Presentation**: Uniform appearance enhanced shelf appeal.
- **Integrated QA Workflow**: Automated data trending reduced manual inspection time.
- **Reduced Waste**: Early detection of color imbalance prevented costly rework.

By implementing the Agera L2, the detergent pod manufacturer established a comprehensive appearance assurance system, combining color, gloss, and UV stability metrics for reliable global quality performance.

4. Denim

1. Improving Appearance Control in Industrial Equipment Coatings
2. Achieving Accurate Color Control for Low-Reflectance Pigments in Architectural Paints
3. Standardizing Appearance and Gloss in Coil Coatings

Case Study 1 – Improving Shade Uniformity and Wash Consistency in Denim Fabric Production

A leading denim fabric manufacturer supplying major global apparel brands sought to achieve greater color consistency and repeatability across weaving, finishing, and garment washing operations. As premium and fast-fashion markets demanded predictable shading and wash-down behavior, the company needed a reliable method to quantify subtle dye variations across rolls and production batches.

Case Study 1 – Improving Shade Uniformity and Wash Consistency in Denim Fabric Production

Customer Challenge:

Traditional visual grading methods were highly subjective, particularly under variable lighting conditions. Operators found it difficult to judge small differences in indigo tone and fading response, leading to inconsistencies between fabric lots.

Specific challenges included:

- Shade variation between rolls due to indigo dye bath oxidation drift.
- Inconsistent wash-down results between batches, affecting garment uniformity
- Difficulty correlating in-process readings with post-launder appearance.
- Lack of objective ΔE standards for supplier-to-brand communication.

HunterLab

Case Study 1 – Improving Shade Uniformity and Wash Consistency in Denim Fabric Production

Solution Implementation:

The manufacturer implemented the Agera L2 as the laboratory and production standard for denim fabric evaluation.

Using the 0° illumination / 45° circumferential geometry, the instrument captured the true color interaction of light with twill surfaces, averaging directional scatter from fabric weave and texture.

CIELAB and ΔE2000 data were trended before and after washing to quantify tone stability, and UV-included/excluded illumination was used to detect any fluorescence or brightener interference.

With EasyMatch Essentials, the mill established a digital shade library for brand alignment and global supplier standardization.

Case Study 1 – Improving Shade Uniformity and Wash Consistency in Denim Fabric Production

Benefits / Outcomes:

- **Improved Shade Control**: ΔE variation between rolls reduced from 0.45 to 0.15 through precise bath monitoring.
- **Predictable Wash Behavior**: Quantified pre-/post-launder color change enabled consistent garment outcomes.
- **Objective Communication**: Digital color standards eliminated subjective disputes between suppliers and brand auditors.
- **Enhanced Production Efficiency**: Reduced manual shade sorting and re-dyeing requirements.
- **Brand Confidence**: Repeatable color verification reinforced premium product positioning.

By introducing the Agera L2, the denim manufacturer transformed subjective shade evaluation into objective, repeatable color management–achieving measurable consistency from dye house to final garment.

HunterLab

Case Study 2 – Optimizing Indigo Rope Dyeing Uniformity for Warp Yarns

A large warp yarn dyeing operation specializing in indigo and sulfur rope-dyed yarns required improved process control to maintain color uniformity and oxidation balance across multiple ropes during continuous dyeing. The company's goal was to eliminate variation before weaving, reducing fabric shading issues downstream.

HunterLab

Case Study 2 – Optimizing Indigo Rope Dyeing Uniformity for Warp Yarns

Customer Challenge:

Rope dyeing involves multiple oxidation cycles where oxygen exposure, bath temperature, and reduction chemistry determine final color tone.

Key challenges included:

- Uneven oxidation resulting in tone drift between ropes within the same lot.
- Batch inconsistencies causing visible weaving stripes and panel shading.
- Visual inspection limited by lighting variability and human fatigue.
- Lack of quantitative data to link dye bath performance with final rope color.

Case Study 2 – Optimizing Indigo Rope Dyeing Uniformity for Warp Yarns

Solution Implementation:

The Agera L2 was installed at the laboratory and quality checkpoints of the dye range.

Using the large 51 mm port, multiple yarns were measured simultaneously, averaging across bundles to ensure representative data.

ΔE and spectral reflectance were monitored between oxidation stages to confirm bath equilibrium.

UV-included/excluded readings identified potential photo-reactive shifts or sulfurization anomalies.

Results were trended using EasyMatch Essentials and correlated with inline SpectraTrend HT sensors for closed-loop feedback.

Case Study 2 – Optimizing Indigo Rope Dyeing Uniformity for Warp Yarns

Benefits / Outcomes:

- **Stable Rope Tone Control**: Consistent oxidation levels maintained across dye lots.
- **Reduced Weaving Defects**: Elimination of visible shading bands and stripe effects.
- **Enhanced Process Feedback**: Real-time color trending enabled proactive bath adjustments.
- **Improved Efficiency**: Lower dye waste and reduced reprocessing time.
- **Data Integration**: Digital trending ensured traceability and reproducibility for quality audits.

The Agera L2 enabled precise color tracking during rope dyeing, linking laboratory and production data to deliver consistent yarn color uniformity before weaving—critical for maintaining denim fabric shade reliability.

Case Study 3 – Ensuring Global Brand Consistency in Denim Finishing

A premium global denim brand managing multiple wash and finishing facilities worldwide needed to standardize appearance and shade across suppliers. Differences in local water chemistry, enzymes, and finishing recipes created perceptible inconsistencies in final garment color and brightness.

Case Study 3 – Ensuring Global Brand Consistency in Denim Finishing

Customer Challenge:

Even when using identical base fabrics, garment finishing produced noticeable shade variation across regions.

The primary challenges included:

- Inconsistent color results between wash houses due to process variations.
- Lack of unified, instrument-based tolerances for finished garments.
- Difficulty verifying shade equivalency during brand audits.
- Subjective visual judgment leading to high rejection rates.

HunterLab

Case Study 3 – Ensuring Global Brand Consistency in Denim Finishing

Solution Implementation:

The Agera L2 was selected as the global reference instrument for all denim finishing and brand QA facilities.

Using 0°/45° circumferential geometry, the Agera L2 measured finished garments and laundered panels, ensuring true visual correlation across lighting and texture differences.

CIELAB and ΔE2000 tolerances were established and shared digitally through EasyMatch Essentials to ensure identical interpretation at every site.

Image capture functionality provided visual verification alongside numeric data for audit reporting and supplier communication.

Case Study 3 – Ensuring Global Brand Consistency in Denim Finishing

Benefits / Outcomes:

- **Global Color Standardization**: Unified ΔE2000 thresholds adopted across all finishing facilities.
- **Reduced Disputes**: Objective color data replaced subjective interpretation in brand reviews.
- **Improved Cross-Site Coordination**: Shared digital color standards streamlined supplier communication.
- **Predictable Wash Appearance**: Quantitative tracking of wash-down ΔE ensured visual consistency.
- **Brand Protection**: Consistent appearance reinforced product recognition and trust worldwide.

By implementing the Agera L2 as the cornerstone of global shade alignment, the brand established a traceable, data-driven color governance system, ensuring every denim garment delivered the

5. Paint and Coatings

1. Improving Appearance Control in Industrial Equipment Coatings
2. Achieving Accurate Color Control for Low-Reflectance Pigments in Architectural Paints
3. Standardizing Appearance and Gloss in Coil Coatings

Case Study 2 – Enhancing Durability and Appearance in Architectural Bridge Coatings

A specialty coatings supplier developing architectural and infrastructure coatings for bridges, towers, and large steel structures required enhanced methods to monitor fade resistance, gloss retention, and pigment durability under harsh UV and environmental exposure.

HunterLab

Case Study 2 – – Enhancing Durability and Appearance in Architectural Bridge Coatings

Customer Challenge:

Architectural bridge coatings are exposed to intense sunlight, salt spray, and pollution–all of which accelerate pigment breakdown and color loss.

Key issues included:

- Inability to correlate accelerated UV chamber results to long-term field performance.
- Color drift and gloss loss over time that were difficult to quantify visually.
- Variability in coating appearance between suppliers and applicators.
- Lack of unified digital color documentation for warranty validation.

The manufacturer needed an instrument capable of measuring color and gloss degradation with traceable accuracy while matching

HunterLab

Case Study 2 – – Enhancing Durability and Appearance in Architectural Bridge Coatings

Solution Implementation:

The Agera L2 was installed in the R&D and QC labs for accelerated weathering studies and production QA.

Its 0°/45° circumferential geometry minimized glare and directional bias, while the integrated 60° gloss sensor quantified gloss retention alongside color.

UV-included/excluded illumination modes helped isolate photo-reactive pigment behavior.

Color and gloss trends were tracked using EasyMatch Essentials, and results were correlated to field inspection data for long-term predictive modeling.

Case Study 2 – – Enhancing Durability and Appearance in Architectural Bridge Coatings

Benefits / Outcomes:

- **Objective Fade Measurement:** Quantified ΔE and gloss loss throughout UV aging cycles.
- **Enhanced Predictive Correlation**: Laboratory ΔE trends aligned with multi-year field performance.
- **Improved Formulation Development**: Enabled verification of new UV-stabilized pigment systems.
- **Quality Traceability**: Data provided digital verification for maintenance and warranty programs.
- **Consistency Across Applications**: Standardized color appearance across contractors and projects.

The Agera L2 became the company's central validation tool–ensuring durable, visually consistent architectural coatings that maintained both color integrity and aesthetic performance over time.

HunterLab

Case Study 1 – Standardizing Color and Gloss in Industrial Equipment Coatings

A global manufacturer of industrial equipment and machinery producing large agricultural, construction, and energy components required precise color and gloss control across powder and liquid coatings. These coatings not only protect equipment from corrosion but also define the company's visual brand identity—where consistent finish quality communicates reliability and precision.

Case Study 1 – Standardizing Color and Gloss in Industrial Equipment Coatings

Customer Challenge:

Despite well-established pigment formulations, coating lines across multiple facilities produced slight but visible appearance differences.

Key issues included:

- Color mismatch between matte and semi-gloss finishes on adjoining parts.
- Batch-to-batch gloss deviation due to cure temperature and film thickness variation.
- Inconsistent readings from older 45°/0° instruments that overemphasized specular reflection.
- Time lost performing separate color and gloss checks with different instruments.

The customer required a single, integrated measurement platform capable of quantifying both color and gloss simultaneously and correlating the data to human visual perception under production conditions.

Case Study 1 – Standardizing Color and Gloss in Industrial Equipment Coatings

Solution Implementation:

The company standardized its laboratories and coating QA stations with the Agera L2, configured for 0° illumination / 45° circumferential viewing geometry. This geometry eliminated glare and ensured visual correlation even on high-build coatings and structured finishes.

The integrated 60° gloss sensor measured specular reflectance alongside color within one reading, while EasyMatch Essentials software enabled ΔE2000 and gloss trending per ASTM D2244 and D523.

Agera L2 instruments were networked to the global LIMS, ensuring uniform appearance control at all plants.

Case Study 1 – Standardizing Color and Gloss in Industrial Equipment Coatings

Benefits / Outcomes:

- **Simultaneous Color + Gloss Analysis**: Eliminated need for separate devices, improving QA throughput by 30%.
- **Improved Visual Uniformity**: Circumferential geometry ensured consistency between matte, satin, and gloss coatings.
- **Reduced Rework and Downtime**: Automated pass/fail data linked directly to batch release criteria.
- Global Color Standardization: Inter-instrument agreement within ≤ 0.10 ΔE across facilities.
- **Enhanced Brand Image**: Consistent coating appearance across all product lines strengthened perceived quality.

The Agera L2 provided a unified, high-precision platform for industrial coating control, enabling consistent color, gloss, and visual appearance from small components to large-scale

Case Study 3 – Establishing Tight Appearance Control in Coil Coating Operations

A multinational coil coating producer supplying pre-painted steel and aluminum for appliances, building panels, and interior systems needed to maintain precise color and gloss uniformity across continuous production runs and global sites.

Case Study 3 – Establishing Tight Appearance Control in Coil Coating Operations

Customer Challenge:

Coil coating lines operate at high speeds, and even minor pigment or oven variations can produce unacceptable ΔE differences or gloss shifts.

Key challenges included:

- Color inconsistency across coil width or between line sections.
- Micro-texture and flow defects undetected by visual inspection.
- Discrepancies between inline and laboratory color readings.
- Time-intensive manual recordkeeping for customer certifications.

The manufacturer needed a high-precision laboratory standard to correlate with inline systems and unify specifications across regional plants.

Case Study 3 – Establishing Tight Appearance Control in Coil Coating Operations

Solution Implementation:

The Agera L2 served as the laboratory master reference for all global coating operations.

Using 0°/45° circumferential geometry and 60° gloss integration, the instrument delivered data precisely correlated to human-eye appearance and field measurements.

Spectral and gloss data were managed through EasyMatch Essentials, which generated automatic certification reports and tolerances per ASTM D2244 and NCCA Technical Bulletin 404.

Agera L2 readings were directly compared to inline sensors (e.g., SpectraTrend HT) for closed-loop process validation.

Case Study 3 – Establishing Tight Appearance Control in Coil Coating Operations

Benefits / Outcomes:

- **Line-to-Lab Correlation**: Established direct visual and numerical consistency between lab and inline sensors.
- **Defect Identification**: Imaging revealed micro-texture or leveling issues invisible to operators.
- **Reduced Color Drift**: Maintained $\Delta E \leq 0.20$ across multiple coating lines.
- **Simplified Documentation**: Automated digital certification for coil release and warranty.
- **Improved Cross-Plant Uniformity**: Color and gloss data standardized across global sites.

By implementing the Agera L2 as its global reference, the coil coating manufacturer achieved worldwide visual consistency and data traceability, unifying product quality and appearance from coil to final installation.

6. Paper

1. Maintaining Brightness and Coating Uniformity in Coated and Uncoated Papers
2. Verifying Color Accuracy in Printing and Packaging Grades
3. Monitoring Whiteness and Softness Perception in Tissue Paper
4. Standardizing Color and Optical Properties in Recycled Paper Grades

Case Study 1 – Maintaining Brightness and Coating Uniformity in Coated and Uncoated Papers

A global paper and specialty coating manufacturer producing fine printing, packaging, and technical papers required a consistent, objective way to measure color, brightness, and gloss uniformity across multiple coating lines and plants. Variation in coating thickness and optical brightener dosage led to perceptible shade differences that impacted print quality and brand image.

HunterLab

Case Study 1 – Maintaining Brightness and Coating Uniformity in Coated and Uncoated Papers

Customer Challenge:

The manufacturer faced significant variation in brightness and shade between production lots and coating machines.

Specific issues included:

- Inconsistent whiteness and gloss between coated and uncoated grades.
- Non-uniform FWA (fluorescent whitening agent) response under UV light.
- Shade and gloss imbalance causing visible differences in print appearance.
- No integrated system linking color, gloss, and UV behavior.

HunterLab

Case Study 1 – Maintaining Brightness and Coating Uniformity in Coated and Uncoated Papers

Solution Implementation:

The company adopted the Agera L2 to measure color, gloss, and brightness simultaneously using 0° illumination / 45° circumferential geometry.

Its UV-included and UV-excluded illumination modes enabled quantification of FWA activity and brightness stability.

Coating uniformity was verified using combined ΔE2000, YI, and 60° gloss metrics.

All data were archived in EasyMatch Essentials for real-time lot trending and supplier certification.

HunterLab

Case Study 1 – Maintaining Brightness and Coating Uniformity in Coated and Uncoated Papers

Benefits / Outcomes:

- **Balanced Shade and Gloss**: Reduced coating variation by 35 %.
- **FWA Control**: Quantified UV response ensured stable brightness and regulatory compliance.
- **Comprehensive Appearance Analysis**: Integrated color + gloss + image data in one workflow.
- **Improved Print Predictability**: Uniform coating performance across paper grades.
- **Traceable Quality Assurance**: Automated reporting simplified customer audits.

By integrating the Agera L2, the paper producer achieved precise, repeatable control of color and appearance–transforming subjective coating evaluation into digital process intelligence.

HunterLab

Case Study 2 – Verifying Color Accuracy in Printing and Packaging Paper

A major printing-paper and packaging converter required dependable color verification and gloss correlation for high-speed press proofing and packaging approval.

Color deviations between coated stocks and print batches caused costly reprints and brand inconsistencies.

Case Study 2 – Verifying Color Accuracy in Printing and Packaging Paper

Customer Challenge:

- Press proofs and production runs showed visible color drift across substrates.
- Gloss variation between matte and gloss finishes distorted color perception.
- Visual inspection lacked numeric consistency for global customer approvals.
- No standardized ΔE tolerance system across paper, ink, and coating suppliers.

Case Study 2 – Verifying Color Accuracy in Printing and Packaging Paper

Solution Implementation:

The Agera L2's 0°/45° circumferential geometry and integrated 60° gloss sensor enabled simultaneous measurement of color and finish.

CIELAB and ΔE2000 values were compared across print lots and substrates, linking visual press proofs to instrument data.

EasyMatch Essentials established digital color libraries with automatic pass/fail tolerances for brand-specific targets

Case Study 2 – Verifying Color Accuracy in Printing and Packaging Grades

Benefits / Outcomes:

- **Visual–Numeric Alignment**: Harmonized press approval between print operators and brand QA teams.
- **Gloss Compensation**: Simultaneous gloss data eliminated misinterpretation of sheen vs. pigment variation.
- **Reduced Waste**: Fewer reprints and faster sign-off on packaging colors.
- **Consistent Global Proofing**: Color tolerances applied uniformly across supplier networks.
- **Customer Confidence**: Objective data reinforced brand integrity and print quality.

The Agera L2 provided a quantifiable link between perceived color and measurable performance—ensuring flawless print reproduction across packaging lines and international markets.

Case Study 3 – Monitoring Whiteness in Tissue Paper

A manufacturer of facial and bathroom tissues required reliable quantification of whiteness, brightness, and appearance softness, critical attributes influencing consumer perception.
Traditional reflectance measurements failed to capture the combined effects of optical brighteners, fiber dispersion, and surface texture.

Case Study 3 – Monitoring Whiteness in Tissue Paper

Customer Challenge:

- Whiteness variation from recycled fiber mix and optical brightener load.
- Surface irregularities affecting reflectance readings.
- No objective link between color data and perceived "softness."
- Inconsistent results between production shifts.

HunterLab

Case Study 3 – Monitoring Whiteness in Tissue Paper

Solution Implementation:

The Agera L2 measured tissue color directly using its large 51 mm port, averaging data across textured, embossed, or multi-ply surfaces.

UV-included/excluded modes quantified optical brightener stability and performance.

CIELAB and YI values were trended in EasyMatch Essentials to monitor pulp consistency and bleaching efficiency.

Gloss data (optional) supported visual uniformity checks for premium tissue brands.

HunterLab

Case Study 3 – Monitoring Whiteness in Tissue Paper

Benefits / Outcomes:

- **Stable Whiteness Control**: ΔE variation reduced by 45 % across production lines.
- **Improved Softness Perception**: Uniform shade linked with smoother visual texture.
- **Optimized FWA Usage**: Reduced over-brightener consumption while maintaining target appearance.
- **Rapid Batch Verification**: Real-time pass/fail feedback improved productivity.
- **Objective Brand Differen**tiation: Quantitative appearance data supported product marketing claims.

With the Agera L2, the tissue manufacturer connected whiteness and brightness data directly to consumer-perceived quality–delivering reliable, repeatable color control in one streamlined process.

Case Study 4 – Standardizing Color and Optical Properties in Recycled Paper Grades

A recycling-based paper producer manufacturing office and packaging papers sought to achieve consistent brightness and tone despite variable input fiber quality. Maintaining uniform appearance was essential for meeting customer and environmental branding requirements.

HunterLab

Case Study 4 – Standardizing Color and Optical Properties in Recycled Paper Grades

Customer Challenge:

- Unpredictable shade and brightness shifts due to recycled fiber variability.
- Residual inks and contaminants altering color balance.
- Inconsistent optical brightener carry-over from incoming pulp streams.
- Limited ability to quantify visual differences in blended stock.

HunterLab

Case Study 4 – Standardizing Color and Optical Properties in Recycled Paper Grades

Solution Implementation:

The Agera L2 measured color and brightness at multiple stages–post-deinking, pre-bleaching, and final sheet.

Its UV-controlled illumination differentiated between intrinsic fiber color and optical brightener effects.

CIELAB and YI metrics were logged in EasyMatch Essentials for real-time process trending.

Results guided chemical dosage optimization and allowed visual color matching between recycled and virgin fiber grades.

HunterLab

Case Study 4 – Standardizing Color and Optical Properties in Recycled Paper Grades

Benefits / Outcomes:

- **Improved Recycled Brightness**: Controlled YI and ΔE variation within tight specifications.
- **Process Optimization**: Reduced bleaching chemical use by 20 % with maintained appearance.
- **Enhanced Quality Consistency**: Stable tone and whiteness across recycled lots.
- **Environmental Transparency**: Data-based documentation supported sustainability reporting.
- **Customer Retention**: Reliable aesthetic quality strengthened acceptance of recycled products.

The Agera L2 gave recycled-paper manufacturers the precision and repeatability of a laboratory instrument with the practicality of a production tool—delivering quantifiable color, brightness, and optical uniformity for high-value sustainable grades.

7. Plastics

1. Achieving Accurate Color Control for Low-Reflectance Black Pigments in Architectural Coatings
2. Ensuring Color and Gloss Uniformity in Extruded Sheet Plastics
3. Maintaining Appearance Consistency in Vinyl Siding Manufacturing
4. Verifying Color and Surface Uniformity in Profile Extrusions (Windows, Molding, and Trim)

Case Study 1 – Controlling Optical Brightener and Recycled Feedstock Variation in Plastic Pellets

A major resin manufacturer producing polyethylene terephthalate (PET) and recycled PET (rPET) pellets for packaging and preform extrusion sought to improve color consistency and optical brightener control across mixed feedstock production. Their products supply converters producing transparent to opaque bottles, films, and caps, where brightness, bluish undertone, and appearance uniformity are critical to perceived quality and brand differentiation.

Case Study 1 – Controlling Optical Brightener and Recycled Feedstock Variation in Plastic Pellets

Customer Challenge:

The incorporation of recycled PET introduced unpredictable color drift and haze, particularly in high-whiteness or clear applications. Conventional colorimeters and sphere-based spectrophotometers failed to provide reliable data due to optical brightener variability and batch-to-batch feedstock differences.

Key issues included:

- Inconsistent whiteness and undertone between virgin and recycled lots, creating visible variation in molded parts.
- Over-brightened blends caused by uncontrolled OBA (optical brightener agent) carry-over from regrind.
- Operator-dependent visual assessment that led to subjective batch release decisions.
- Lack of UV control, preventing accurate quantification of fluorescence and yellowing tendency.

The manufacturer required an instrument capable of separating fluorescence effects from true color, quantifying brightness stability, and correlating color data to visual perception under controlled UV conditions.

Case Study 1 – Controlling Optical Brightener and Recycled Feedstock Variation in Plastic Pellets

Solution Implementation:

The team selected the Agera L2, leveraging its 0° illumination / 45° circumferential viewing geometry for true human-eye correlation on opaque pellets and compression-molded plaques.

The UV-included / excluded measurement modes isolated and quantified OBA response, while the high-dynamic-range detector accurately measured reflectance differences across recycled and virgin resin blends.

Using EasyMatch Essentials software, operators established digital ΔE2000 tolerances and automated trend tracking to monitor pellet whiteness, YI, and L* uniformity during blending and extrusion.

Data integration into the plant's LIMS system enabled real-time release decisions and traceable lot-to-lot color certification.

Case Study 1 – Controlling Optical Brightener and Recycled Feedstock Variation in Plastic Pellets

Benefits / Outcomes:

- **Improved Whiteness Consistency:** Reduced batch-to-batch ΔE variation from 0.45 to 0.12 through precise OBA control.
- **Quantified Fluorescence Response**: UV-mode separation revealed additive imbalance undetectable by standard instruments.
- **Objective Feedstock Evaluation**: Color trending verified recycled content stability without compromising appearance.
- **Process Efficiency Gains**: Automated measurement and digital tolerances shortened approval time by 30 %.
- **Data-Driven Quality Assurance**: Centralized records provided auditable proof of color conformity for global customers.

By implementing the Agera L2, the manufacturer achieved scientifically traceable color control across mixed-resin operations, ensuring that sustainability goals using rPET could be met without sacrificing brightness, appearance, or brand quality.

Case Study 2 – Achieving Uniform Color and Gloss in Extruded Plastic Sheet Production

A global manufacturer of extruded plastic sheets serving the packaging, signage, and industrial thermoforming sectors sought to improve color and surface uniformity across multiple production lines and material grades. Their product portfolio included opaque, translucent, and pigmented sheets where appearance quality, gloss balance, and consistency between batches directly affected customer satisfaction and downstream fabrication yield.

Case Study 2 – Achieving Uniform Color and Gloss in Extruded Plastic Sheet Production

Customer Challenge:

Color and gloss variation emerged between extrusion lines and resin formulations, leading to costly rework and off-spec production. The company relied on visual inspection and handheld colorimeters, which proved inadequate for detecting subtle differences caused by line speed, melt temperature, or cooling rate changes.

Common issues included:

- Inconsistent shade and surface reflectance between lots or production lines.
- Visual mismatch between matte and semi-gloss finishes despite similar numerical color readings.
- Manual inspection subjectivity, especially for textured or patterned sheet surfaces.
- Lack of integrated color and gloss data prevented efficient process correlation and corrective action.

The customer required an instrument that could accurately measure both color and gloss simultaneously, providing objective, reproducible data aligned with human

HunterLab

Case Study 2 – Achieving Uniform Color and Gloss in Extruded Plastic Sheet Production

Solution Implementation:

The manufacturer adopted the Agera L2 as its centralized laboratory standard for color and gloss control across extrusion and calendaring lines.

- Using the 0° illumination / 45° circumferential viewing geometry, the Agera L2 captured true visual color response, even on textured or patterned sheets. Its integrated 60° gloss sensor measured surface reflectivity in the same reading, enabling full appearance characterization.

- The EasyMatch Essentials software was configured to automatically compare ΔE2000 and gloss deviation against digital master standards, while trend charts identified drift linked to processing variables such as resin blend or cooling conditions.

- Data was uploaded to the plant's LIMS and SPC system, establishing a

Case Study 2 – Achieving Uniform Color and Gloss in Extruded Plastic Sheet Production

Benefits / Outcomes:

- **Simultaneous Color + Gloss Measurement**: One instrument provided complete appearance data, eliminating separate gloss meter checks.
- **Enhanced Line-to-Line Consistency**: ΔE variation reduced by 40% through real-time correlation with processing parameters.
- **Improved Visual Correlation**: Circumferential geometry neutralized gloss and texture bias for human-eye alignment.
- **Faster Quality Approvals:** Automated pass/fail decisions cut release time by 25%, reducing downtime between product changeovers.
- **Data Integrity and Traceability**: Color and gloss data archived digitally for ISO 9001 and customer audit compliance.

By integrating the Agera L2 into routine QA and process verification, the manufacturer achieved true visual and numerical alignment across extrusion lines–delivering sheets that met both aesthetic and dimensional quality standards, while reducing rework and scrap costs.

Case Study 3 –Ensuring Color Consistency and Texture Accuracy in Vinyl Siding Production

A North American manufacturer of vinyl siding and trim panels supplying both residential and commercial markets sought to improve color uniformity and fade resistance across multiple embossing textures and production lines. The company's reputation relied heavily on maintaining consistent visual appearance between lots, textures, and installation batches under varying lighting conditions.

HunterLab

Case Study 3 –Ensuring Color Consistency and Texture Accuracy in Vinyl Siding Production

Customer Challenge:

Textured surfaces and gloss variation made visual color comparison unreliable. Existing spectrophotometers provided inconsistent readings depending on surface pattern, while gloss meters failed to correlate with perceived appearance.

The manufacturer's primary issues included:

- Visible color mismatch between embossed and smooth panels despite matching numerical values.
- Inconsistent ΔE readings across production shifts due to orientation and surface geometry.
- Inability to verify fade resistance accurately during accelerated weathering tests.

Case Study 3 –Ensuring Color Consistency and Texture Accuracy in Vinyl Siding Production

Solution Implementation:

The Agera L2 was introduced as a production-standard color and gloss measurement system.
Its 0° illumination / 45° circumferential geometry averaged readings across ridges and valleys of textured siding, providing true visual correlation.

The integrated 60° gloss sensor quantified sheen variation in a single measurement, ensuring total appearance alignment between panels.

Using EasyMatch Essentials, the QC team established master color standards for each texture, and automated ΔE2000 pass/fail thresholds were linked directly to the plant's ERP and LIMS systems for traceable batch verification.

Accelerated UV fade data was correlated with Agera L2 results to predict long-term outdoor color performance.

Case Study 3 –Ensuring Color Consistency and Texture Accuracy in Vinyl Siding Production

Benefits / Outcomes:

- **Visual Correlation Across Textures**: Circumferential geometry eliminated directionality bias on embossed or matte surfaces.
- **Color + Gloss Integration**: Unified appearance data captured in one reading for total aesthetic validation.
- **Reduced Subjectivity:** Automated digital tolerances removed human interpretation errors.
- **Improved Fade Correlation**: Predictive ΔE trend models aligned laboratory weathering results with field performance.
- **Operational Efficiency**: 30% faster lot approval and reduced shade-sorting time across shifts.

By standardizing with the Agera L2, the siding manufacturer achieved consistent, visually accurate color performance across every profile, texture, and facility–strengthening brand reliability in

HunterLab

Case Study 4 – Achieving Dimensional and Color Uniformity in Extruded Window Profiles

A global supplier of PVC and composite window profiles serving the architectural and construction industries required tighter color, gloss, and surface consistency between extruded frame components. Customers demanded exact matches across welded sections, mullions, and sashes produced at multiple facilities under varying conditions.

HunterLab

Case Study 4 – Achieving Dimensional and Color Uniformity in Extruded Window Profiles

Customer Challenge:

Traditional color measurement tools failed to align visual appearance across parts with different orientations and gloss levels.

Key concerns included:

- Slight hue and brightness variation between batches or plants creating perceptible mismatch during assembly.
- Inconsistent gloss or surface finish caused by variable cooling rates.
- Manual inspection subjectivity during production release.
- Lack of traceable numerical standards linking color and gloss results globally.

HunterLab

Case Study 4 – Achieving Dimensional and Color Uniformity in Extruded Window Profiles

Solution Implementation:

The Agera L2 was selected to unify appearance control across all facilities.

Its 0°/45° circumferential viewing geometry replicated human-eye response, eliminating gloss bias, while the integrated 60° gloss sensor provided quantitative finish assessment.

Color and gloss standards were created for each profile type within EasyMatch Essentials, enabling automated ΔE and gloss tolerancing.

Data was synchronized through the company's LIMS platform, ensuring consistent specification conformance and digital traceability.

Case Study 4 – Achieving Dimensional and Color Uniformity in Extruded Window Profiles

Benefits / Outcomes:

- **Color Harmonization Across Facilities**: Achieved inter-instrument agreement ≤ 0.10 ΔE globally.
- **Complete Appearance Integration**: Simultaneous color and gloss data correlated to visual evaluation.
- **Process Stability Verification**: ΔE and gloss trend analysis flagged extrusion temperature drift early.
- **Faster Quality Approvals**: Average QA inspection time reduced by 35%.
- **Customer Confidence**: Verified consistency improved OEM partner satisfaction and reduced field complaints.

The Agera L2 established a unified, data-driven appearance control system—enabling consistent product quality, reduced rework, and improved interplant communication for window profile manufacturers worldwide.

HunterLab

8. Textile Laundering

1. Quantifying Color Change and Surface Effects in Laundered Fabrics and Apparel Textiles
2. Evaluating UV and Sunlight Degradation in Outdoor Textiles
3. Aligning Supplier-to-Brand Color Standards Across Global Textile Networks

Case Study 1 – Quantifying Color Change and Surface Effects in Laundered Fabrics and Apparel Textiles

A global apparel manufacturer specializing in performance and lifestyle fabrics needed to objectively measure color and appearance changes after laundering to support product claims for colorfastness and durability. Manual visual grading was inconsistent and failed to correlate with laboratory data or brand specifications.

HunterLab

Case Study 1 – Quantifying Color Change and Surface Effects in Laundered Fabrics and Apparel Textiles

Customer Challenge:

Repeated wash cycles introduced both color and texture changes that were difficult to quantify using traditional methods.

The company struggled with:

- Inconsistent ΔE evaluations between facilities and operators.
- Surface pilling and abrasion affecting perceived brightness and tone.
- Lack of numeric data linking wash conditions to fabric durability.
- Unverified claims regarding "color retention after 50 washes."

HunterLab

Case Study 1 – Quantifying Color Change and Surface Effects in Laundered Fabrics and Apparel Textiles

Solution Implementation:

The Agera L2 provided precise, repeatable color and imaging data before and after laundering.

Using 0°/45° circumferential geometry, the instrument averaged reflectance across fabric textures to remove shadowing effects.

ΔE, ΔL*, Δa*, and Δb* values were compared across multiple wash cycles following ISO 105-C06 and AATCC 61 test methods.

The integrated imaging capability documented surface phenomena–such as fibrillation, pilling, and wear–while EasyMatch Essentials software trended changes over time to validate product

Case Study 1 – Quantifying Color Change and Surface Effects in Laundered Fabrics and Apparel Textiles

Benefits / Outcomes:

- **Objective Wash Performance Data**: Quantified ΔE color shifts across laundering cycles.
- **Texture-Aware Measurement**: Imaging captured physical changes alongside color data.
- **Reliable Cross-Site Testing**: Inter-lab ΔE repeatability within ±0.05 ensured consistency.
- **Faster Certification**: Automated trending simplified AATCC and ISO compliance reporting.
- **Enhanced Brand Credibility**: Verified "wash durability" claims with traceable, instrument-based data.

With the Agera L2, the apparel manufacturer converted subjective durability testing into a quantitative, auditable process—ensuring every fabric maintained its intended appearance after repeated consumer use.

HunterLab

Case Study 2 – Evaluating UV and Sunlight Degradation in Outdoor Textiles

A supplier of outdoor fabrics and technical textiles for marine, upholstery, and performance gear required reliable methods to measure UV-induced color fading and material degradation. Their customers demanded verified color stability for extended outdoor exposure, but traditional evaluations lacked quantitative consistency.

Case Study 2 – Evaluating UV and Sunlight Degradation in Outdoor Textiles

Customer Challenge:

Prolonged UV exposure caused brighteners and dyes to degrade unevenly, producing visible fading and discoloration.

Challenges included:

- Inconsistent manual fade ratings under uncontrolled light sources.
- No standardized method to isolate UV contribution from total color loss.
- Difficulty correlating instrumental data with visual “Blue Wool” fade scales.
- Lack of traceable records for product warranty validation.

HunterLab

Case Study 2 – Evaluating UV and Sunlight Degradation in Outdoor Textiles

Solution Implementation:

The Agera L2 was used to measure samples before and after accelerated UV exposure.

Its UV-included and UV-excluded illumination modes allowed engineers to isolate the specific effects of ultraviolet radiation on color loss and brightness drift.

CIELAB data, ΔE2000 values, and brightness indices were compared against Blue Wool reference scales, while EasyMatch Essentials software tracked degradation rates over time.

The combined spectral and visual data provided comprehensive fade profiling for each fabric formulation.

Case Study 2 – Evaluating UV and Sunlight Degradation in Outdoor Textiles

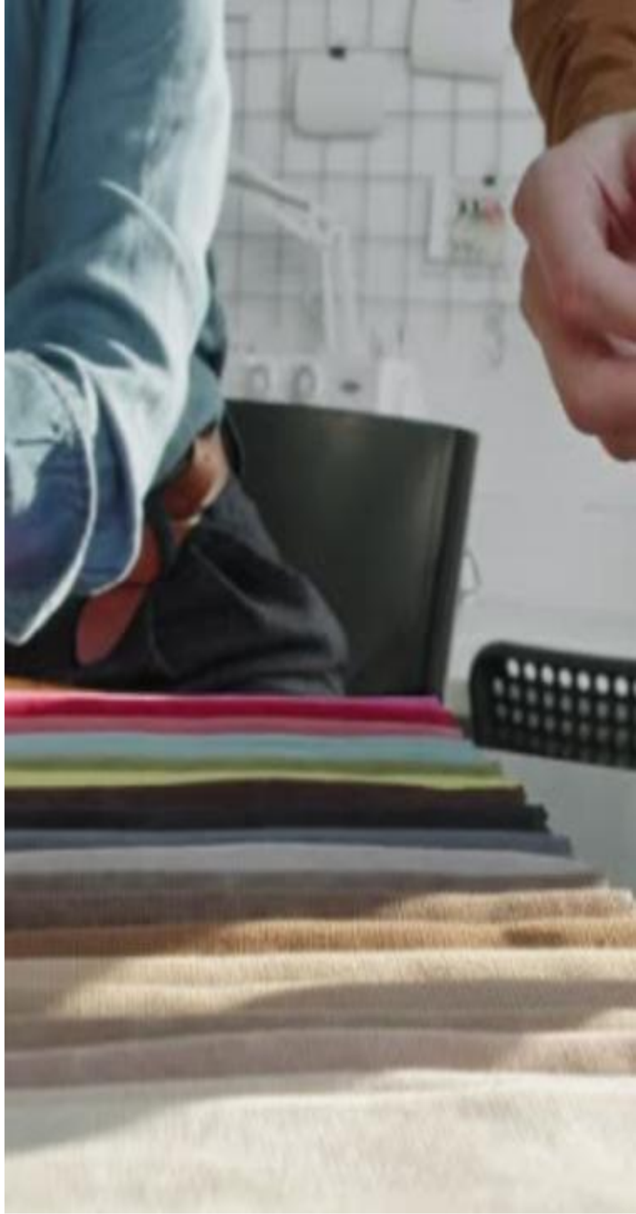
Benefits / Outcomes:

- **Accurate UV-Fade Measurement**: Isolated color change directly attributable to UV exposure.
- **Improved Product Validation**: Quantified fade resistance for customer warranty support.
- **Standardized Reporting**: Digital ΔE and L*, a*, b* data correlated with Blue Wool standards.
- **Enhanced Formulation Feedback**: Identified dyes and finishes most susceptible to UV degradation.
- **Predictable Outdoor Performance**: Established data-driven benchmarks for product claims.

The Agera L2 enabled fabric manufacturers to measure and manage UV degradation scientifically—ensuring durable, fade-resistant color performance in every outdoor textile.

Case Study 3 – Aligning Supplier-to-Brand Color Standards Across Global Textile Networks

A major global apparel brand sourcing from multiple textile mills across Asia, Europe, and the Americas sought to unify color tolerance standards and laundering alignment to maintain brand consistency worldwide.



HunterLab

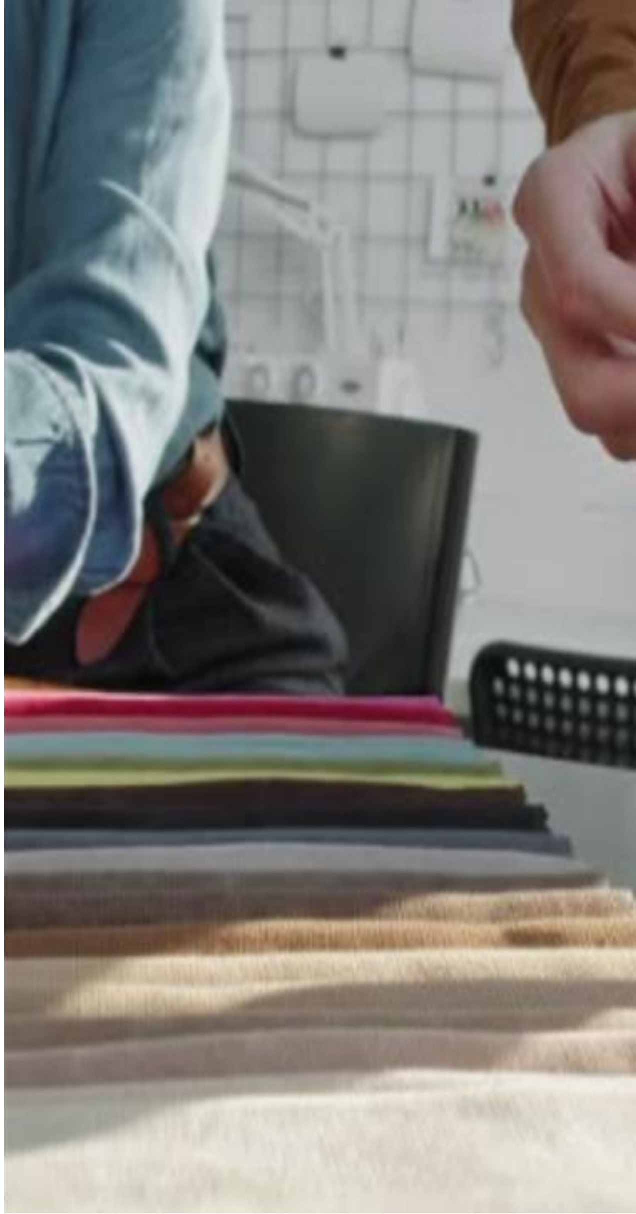
Case Study 3 – Aligning Supplier-to-Brand Color Standards Across Global Textile Networks

Customer Challenge:

Different suppliers interpreted "acceptable shade" differently due to inconsistent instrumentation, lighting, and wash testing.

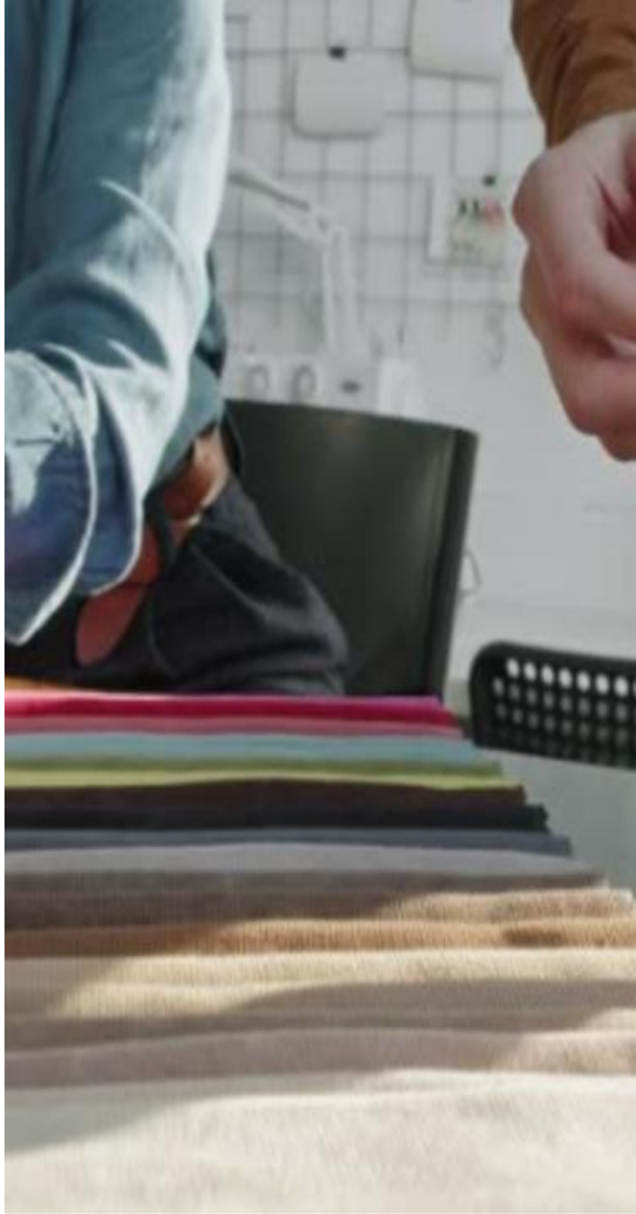
Primary issues included:

- ΔE tolerances not uniformly applied across facilities.
- Color drift after laundering leading to off-shade product returns.
- Disputes between suppliers and brand QA teams due to subjective inspection.
- No centralized digital record for compliance verification.



HunterLab

Case Study 3 – Aligning Supplier-to-Brand Color Standards Across Global Textile Networks



Solution Implementation:

The Agera L2 was adopted as the global reference instrument for the brand's approved supplier network.

Its 0°/45° circumferential geometry ensured visual correlation between measurement and human perception across fiber types and finishes.

Global ΔE2000 and YI tolerance thresholds were defined within EasyMatch Essentials, and UV-included/excluded readings standardized evaluation of optical brightener effects after washing and wear.

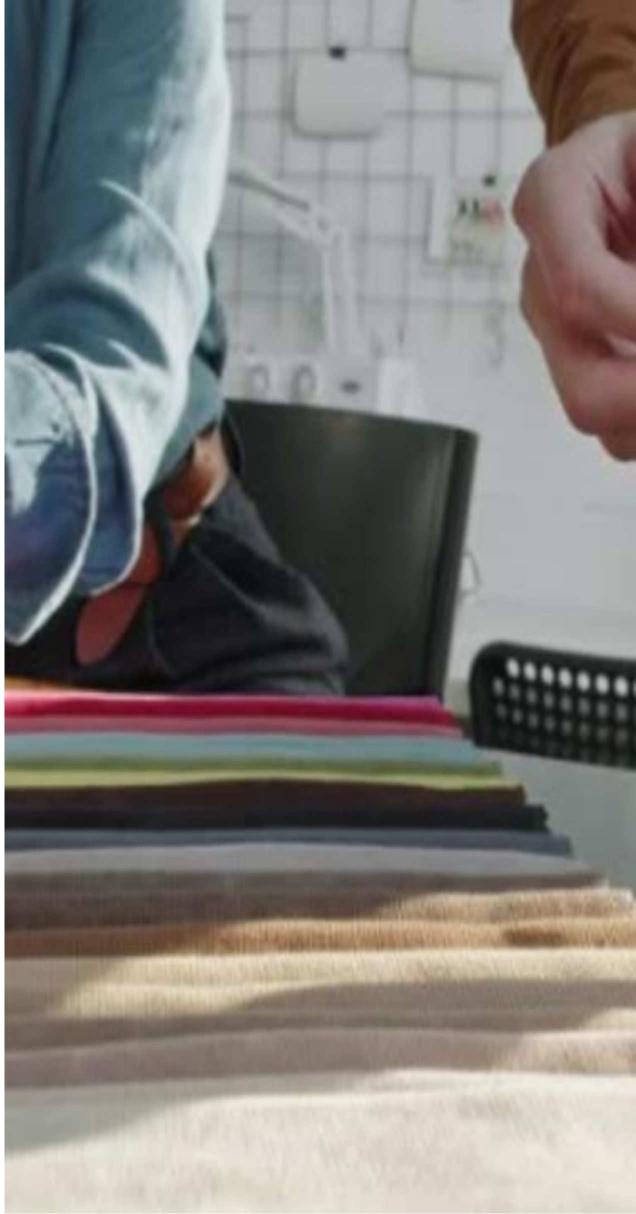
Data was synchronized with the brand's supplier portal, allowing instant digital comparison and documentation.

Case Study 3 – Aligning Supplier-to-Brand Color Standards Across Global Textile Networks

Benefits / Outcomes:

- **Global Standardization**: Unified measurement geometry and tolerances across all suppliers.
- **Reduced Rejection Rates**: Color disputes decreased by 60 %.
- **Objective Verification**: Data-driven alignment replaced visual subjectivity.
- **Improved Post-Wash Consistency**: Controlled ΔE variation across laundered garments.
- **Audit-Ready Reporting**: Digital traceability supported brand QA and compliance requirements.

The Agera L2 established a universal language of color and appearance for the global textile supply chain—enabling brand integrity, faster supplier qualification, and measurable improvement in product uniformity.



9. Textiles

1. Standardizing Shade and Finish Quality in Dyed and Finished Fabrics
2. Controlling Optical Brighteners and Texture Effects in Synthetic Fibers
3. Evaluating Whiteness and Surface Appearance in Natural Fibers and Blends
4. Quantifying Surface Sheen and Finish Quality in Textile Appearance Analysis

HunterLab

Case Study 1 – Standardizing Shade and Finish Quality in Dyed and Finished Fabrics

A leading textile mill producing dyed and finished woven fabrics for fashion, upholstery, and performance apparel required tighter color and finish consistency between production lots. Brand customers demanded repeatable shades across mills and fabric constructions, with numerical verification of colorfastness and finishing stability.

Case Study 1 – Standardizing Shade and Finish Quality in Dyed and Finished Fabrics

Customer Challenge:

Despite using automated dye ranges, visual evaluation remained subjective–particularly under varying light sources.

Key issues included:

- Shade variation between dye lots caused by process drift or chemical aging.
- Inconsistent brightness and hue after heat-set or finishing.
- Lack of correlation between instrumental data and visual acceptance.
- No objective documentation for customer audits or brand approval.

HunterLab

Case Study 1 – Standardizing Shade and Finish Quality in Dyed and Finished Fabrics

Solution Implementation:

The mill installed the Agera L2 at laboratory and production checkpoints to measure color, brightness, and finish quality under both UV-included and UV-excluded illumination.

Using 0°/45° circumferential geometry, the instrument averaged reflectance across weave texture and directional yarn effects.

ΔE, ΔL^*, Δa^*, Δb^*, and YI data were monitored in EasyMatch

Essentials to quantify variation after dyeing and finishing, ensuring alignment with color standards.

Process engineers used the data to optimize temperature, pH, and dwell times for greater shade reproducibility.

Case Study 1 – Standardizing Shade and Finish Quality in Dyed and Finished Fabrics

Benefits / Outcomes:

- **Improved Shade Consistency**: ΔE variation between lots reduced by 40 %.
- **Objective Appearance Control**: UV modes isolated brightener and finish effects.
- **Reduced Re-dyeing**: Fewer reworks and faster batch approval cycles.
- **Verified Colorfastness**: Quantitative ΔE trending after washing validated durability.
- **Enhanced Brand Confidence**: Digital records supported global quality assurance.

The Agera L2 replaced subjective inspection with quantitative, traceable shade control–delivering repeatable color harmony across fabrics, finishes, and production sites.

Case Study 2 – Controlling Optical Brighteners and Texture Effects in Synthetic Fibers

A manufacturer of polyester and nylon fibers supplying the apparel and carpet industries sought to precisely manage optical brightener (OBA) performance and color uniformity during extrusion and texturization

Case Study 2 – Controlling Optical Brighteners and Texture Effects in Synthetic Fibers

Customer Challenge:

Synthetic fibers presented unique optical challenges due to filament reflectance and fluorescence.

The team faced:

- Hue shifts from brightener concentration and UV reactivity.
- Color inconsistency across deniers and filament orientations.
- Difficulty quantifying brightness under different light sources.
- Inadequate correlation between lab and bulk appearance.

Case Study 2 – Controlling Optical Brighteners and Texture Effects in Synthetic Fibers

Solution Implementation:

The Agera L2, equipped with UV-included/excluded control and 0° illumination / 45° circumferential geometry, captured the true light interaction with fine filaments and matte yarns.

Measurements were performed on both raw and finished fiber bundles to evaluate brightener efficiency, dye affinity, and texturization impact.

Spectral data and CIELAB coordinates were trended in EasyMatch Essentials to maintain consistency between extrusion lines and finishing plants.

Case Study 2 – Controlling Optical Brighteners and Texture Effects in Synthetic Fibers

Benefits / Outcomes:

- **Accurate Brightness Control**: Quantified OBA contribution for precise dosage.
- **Texture-Independent Results**: Geometry averaged directional scatter from fibers.
- **Reduced Batch Variability**: ΔE deviation cut by 30 % across filament types.
- **Improved UV Stability**: Early detection of photodegradation and yellowing.
- **Cross-Site Alignment**: Unified color targets across multiple facilities.

The Agera L2 gave fiber manufacturers the ability to link formulation, processing, and optical behavior—ensuring predictable brightness, hue, and appearance for every fiber lot.

Case Study 3 – Evaluating Whiteness and Surface Appearance in Natural Fibers and Blends

A vertically integrated cotton and linen processor supplying apparel and home-textile markets needed an objective method to assess fiber cleanliness, whiteness, and finishing quality. Traditional manual grading was inconsistent and could not quantify subtle shade or brightness differences between lots.

HunterLab

Case Study 3 – Evaluating Whiteness and Surface Appearance in Natural Fibers and Blends

Customer Challenge:

Manual grading varied by operator and lighting environment.

Key issues included:

- Subjective evaluation of bleaching efficiency and residual impurities.
- Shade variation from different fiber sources and pre-treatments.
- Inability to verify optical brightener effects after finishing.
- No standardized digital record for traceability.

HunterLab

Case Study 3 – Evaluating Whiteness and Surface Appearance in Natural Fibers and Blends

Solution Implementation:

The Agera L2's large-area measurement port captured an optical average across irregular natural fibers and woven blends.

CIELAB and YI values were compared against ASTM E313 whiteness references to quantify bleach and finish performance.

Integrated gloss and imaging functions evaluated luster, surface sheen, and finishing consistency.

All readings were stored in EasyMatch Essentials for batch trending and brand reporting.

HunterLab

Case Study 3 – Evaluating Whiteness and Surface Appearance in Natural Fibers and Blends

Benefits / Outcomes:

- **Objective Grading**: Numerical whiteness replaced subjective inspection.
- **Improved Process Control**: Quantified bleach uniformity and brightness gain.
- **Texture Averaging**: Eliminated variability from weave irregularities.
- **Finish Evaluation**: Integrated gloss measurement correlated luster and softness.
- **Regulatory Traceability**: Digital records met ISO 9001 quality standards.

The Agera L2 provided the manufacturer with a standardized, traceable method for measuring appearance quality–aligning natural and blended fabrics to modern instrumental color standards.

Case Study 4 – Quantifying Surface Sheen and Finish Quality in Textile Appearance Analysis

A producer of technical and decorative fabrics required objective evaluation of surface texture, gloss, and appearance uniformity for high-performance applications such as automotive interiors, uniforms, and satin apparel.

HunterLab

Case Study 4 – Quantifying Surface Sheen and Finish Quality in Textile Appearance Analysis

Customer Challenge:

Traditional spectrophotometers provided only color data, missing critical differences in surface sheen and texture that influenced perceived color.

Challenges included:

- Variations in luster causing visible mismatches despite identical ΔE.
- Lack of quantitative data for process optimization during calendaring or coating.
- Inability to document texture differences for customer QA.

HunterLab

Case Study 4 – Quantifying Surface Sheen and Finish Quality in Textile Appearance Analysis

Solution Implementation:

The Agera L2 combined color, gloss, and imaging measurement in a single instrument.

Using 0° illumination / 45° circumferential geometry, it captured both the spectral color and visual sheen of smooth, satin, or matte surfaces.

Gloss data at 60° and imaging outputs were analyzed through

EasyMatch Essentials to evaluate texture variation, uniformity, and coating coverage.

Operators established numeric ΔE and GU (gloss unit) tolerances for process control.

Case Study 4 – Quantifying Surface Sheen and Finish Quality in Textile Appearance Analysis

Benefits / Outcomes:

- Comprehensive Appearance Control: Color + gloss + image evaluation in one workflow.
- Reduced Rework: Fewer off-finish rolls identified before shipment.
- Objective Texture Comparison: Quantified differences invisible to color data alone.
- Improved Customer Communication: Gloss and texture data documented product consistency.
- Higher Product Value: Enhanced quality perception and reduced returns.

By integrating the Agera L2, the textile producer achieved a full-spectrum approach to appearance analysis–quantifying not just color, but the surface character that defines how fabrics truly look and feel.

Agera L2 | Cross-Industry Specifications & Connectivity Overview

Specifications

- **Measurement Principle:** Dual-beam Reflectance Spectrophotometer / Glossmeter
- **Geometry: Color:** 0°/45°c (circumferential) ASTM E1164; **Gloss:** 60°
- **Measurement Method:** Port up or Port forward
- **Read Time:** < 3 sec.
- **Image Capture:** High-resolution, D65 illuminated, 45°/0° image viewing, image capture and image recall
- **Port Plate Opening:** Color: XL - 53.97 mm (2.125 in), L - 28.57 mm (1.125 in), M - 17.47 mm (0.688 in)
- **Area Measured: Color:** XLAV - 50.80 mm (2 in), LAV - 25.40 mm (1 in), MAV - 15.89 mm (0.625 in); **Gloss**: 8 mm (5/16 in)
- **Detection Range:** 400 nm - 700 nm
- **Specular Component:** Excluded

Specifications

- **Spectral Resolution:** < 3 nm
- **Effective Bandwidth:** 10 nm equivalent triangular
- **Reporting Interval:** 10 nm
- **Photometric Range:** 0 to 150 %
- **UV Control:** UV Included and UV Excluded with automated comparative data viewing and reporting. Factory calibrated with user option to calibrate to their specific fluorescent standard.
- **Light Source:** High-stability, long-life LED array including near-UV LEDs for fluorescent and OBA detection.
- **LED Life:** 5 years typical
- **Spectrophotometer:** Sealed optics; 256-element diode array; high resolution concave holographic grating

Specifications

- **Illumination/Observer:** Standard D65, CWF, A, F2, F7, F11, and custom user illuminants; 2° and 10° observers ISO 13655 compliant).
- **Standards Conformance: Color:** CIE 15:2018, ASTM E1164, DIN 5033, Teil 7 and JIS Z 8722 Condition C; **Gloss 60°:** ASTM D523, ASTM D2457, ISO 2813, ISO 7668, JIS Z 874
- **Repeatability:** ≤ ΔE 0.02 CIE Lab* avg of 10 white tile measurements).
- **Inter-Instrument Agreement**: ≤ ΔE 0.10 vs HunterLab reference standard (typical). **Measurement Time:** ≤ 2 seconds including color + gloss data acquisition.
- **Operating Modes:** Single, Average, Trend, Compare, Pass/Fail per defined tolerances. Image Capture: Integrated high-resolution camera for visual verification of measurement spot.
- **Color Spaces:** CIELAB, LCh°, XYZ, Yxy, Hunter L,,ab, DIN99, and custom indices.
- **Indices & Metrics:** ΔE 1976, CMC, DE2000 , YI ASTM E313 , Whiteness ASTM E313 / ISO 11475 , Opacity, Gloss GU , Haze (optional calculation).

HunterLab

What's in the box

Standard Configuration Includes

- Agera L2 instrument
- Standards and Port Plate Accessories Box, includes:
- Standards: Calibrated Instrument Standard White Tile), Reflectance Black Glass, Diagnostic Check Tile.
- Port Plates - 2"/51mm LAV2 , 1"/25mm LAV1 , 5/8"/16mm SAV
- Universal Input to 24v Power Supply
- Flash Drive
- Stylus with holder
- Lens Wipe
- Cleaning Cloth
- Quick Start Guide – Agera L2
- Certificate of Calibration
- Certificate of Traceability

Options / Accessories

- Sample Clamp
- 2.5″ Port plate for use with 2.5″ Sample Cup
- 2.5″ Sample Cup
- Ring and disk Set
- Keyboard and Mouse
- Bar Code Scanner
- Automated sample rotation accessory

Service & Support Offerings | Agera L2 Spectrophotometer

Overview

Every Agera L2 system is supported by HunterLab's global service and technical team, ensuring optimal instrument performance, regulatory compliance, and operator confidence from installation through years of operation. The following service programs are designed to complement your purchase and align with both ISO 17025 calibration requirements and Good Manufacturing Practice GMP expectations.

1. Installation & Operator Training

Professional On-Site or Remote InstallationEach Agera L2 is installed and verified by a certified HunterLab Service Specialist. Installation includes instrument setup, performance verification, calibration standardization, and demonstration of measurement procedures. Operator TrainingHands-on training is tailored to your application—plastics, coatings, pharmaceuticals, textiles, or paper—and covers:

- Instrument calibration and daily verification routines
- Sample presentation and port-plate selection
- Data capture, tolerance setup, and pass/fail analysis
- UV-control operation for OBAs/FWAs
- LIMS/SPC data export and workflow optimization

Training sessions may be conducted on-site or via Microsoft Teams

2. Fundamentals of Color and Appearance (FOCA) Training

To build foundational color science understanding and reinforce measurement consistency, HunterLab offers Fundamentals of Color and Appearance FOCA) training, available onsite or via Teams. The FOCA course provides a comprehensive overview of color theory and instrumental color measurement, covering:

- Human color perception and color communication
- Color spaces CIELAB, LCh°, Hunter L,a,b, etc.)
- Light sources, illuminants, and standard observers
- Instrument geometries and their application relevance
- Color differences (ΔE , tolerancing, and appearance variables
- Understanding Haze, Turbidity and Opalescence
- Understanding Color vs Color Apearance
- Fluorescence, OBAs, haze, turbidity, and gloss

HunterLab

3. Annual Calibration & Certification

Factory-Traceable Calibration Services:

Annual certification ensures ongoing accuracy and compliance with internal or customer quality systems. Services include:

- Calibration against NIST-traceable color and gloss standards
- Verification of inter-instrument agreement and ΔE performance
- Gloss calibration validation per ASTM D523 / ISO 2813
- Documentation suitable for ISO 9001, ISO 17025, or GMP audits

A certificate of calibration with traceability records is provided for documentation and audit purposes.

4. Extended Warranty & Preventive Maintenance Plans

Standard Warranty: 1-year parts and labor coverage (return-to-factory or on-site depending on region).Extended Warranty Options – Available in 1 , 2 , or 3-year increments, providing:

- Priority response and loaner coverage
- Annual preventive maintenance visit
- Firmware and software updates EasyMatch Essentials)
- Technical support via phone, email, or remote diagnostics

5. Qualification & Compliance Support Bio-Pharma Focus)

For regulated environments, HunterLab offers Installation Qualification IQ , Operational Qualification OQ , and Performance Qualification PQ documentation and execution services. Deliverables include:

- IQ/OQ/PQ protocols and executed reports
- Verification of audit logging and 21 CFR Part 11 readiness
- Validation of UV-control function and optical performance
- Training certification for GMP personnel

These services ensure that the Agera L2 meets compliance requirements from FDA, EMA, and other global regulatory agencies.

6. Technical Support & Remote Diagnostics

HunterLab's technical support team provides global coverage for troubleshooting, workflow optimization, and application consulting.

Features include:

- Remote diagnostics via secure Ethernet connection
- Real-time log review and software assistance
- Application-specific method development support
- Firmware and feature update notifications

Summary

HunterLab backs every Agera L2 with a comprehensive suite of service, support, and compliance programs that extend beyond installation. Whether in an R&D laboratory, production QC environment, or GMP-regulated facility, these offerings ensure that your instrument remains accurate, validated, and fully supported throughout its operational life.

Agera L2

Color. Confidence. Connected

HunterLab

Redefining accuracy, reliability, and appearance in every measurement

Be sure to visit

hunterlab.com

to learn more about Agera L2, and how HunterLab solutions can help you achieve color confidence, every time, or to schedule a consultation with our color experts.

HunterLab